LAKE ST. CATHERINE

Aquatic Vegetation Management Program

2019 Annual Report

October 2019

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1 INTRODUCTION

The 2019 season was SŌLitude Lake Management's sixteenth year of involvement in an Integrated Management Plan at Lake St. Catherine developed to control non-native Eurasian watermilfoil (*Myriophyllum spicatum*) throughout the lake. Under this plan, Eurasian watermilfoil management efforts have included herbicide treatment, diver assisted suction harvesting (DASH) and hand-pulling, boat ramp monitoring and educating lake residents and users.

In 2019, management activities included spot-treatment of five areas, totaling 38.1 acres with ProcellaCOR EC (florpyrauxifen-benzyl) herbicide as well as diver hand-pulling and diver assisted suction harvesting. These efforts were consistent with the current five-year Integrated Management Plan (2019-2023).

The following report summarizes the results of 2019 Treatment Program and details findings from the late season comprehensive aquatic plant survey that has been performed annually to document in-lake plant conditions and help evaluate and refine management goals. Specific information on the 2019 diver hand-pulling and diver assisted suction harvesting efforts will be provided by the Lake St. Catherine Association (LSCA) under a separate cover.

2 HERBICIDE TREATMENT PROGRAM - 2019

2.1 Program Chronology

A chronology of the 2019 treatment program is provided below:

- Pre-treatment inspection to finalize treatment areas.....May 16
- Treatment of 38.1 acres with ProcellaCOR EC .....July 10
- Herbicide residue monitoring .....July 12
- Comprehensive aquatic plant survey..... September 26 & 27

2.2 Pre-Treatment Inspection

On May 16 the entire littoral area of Lake St. Catherine (Lily Pond, Main Lake and Little Lake) was surveyed by SŌLitude biologist Amanda Mahaney and the Lake St. Catherine DASH operators (Beck Sinclair, Owen Teetor) to assess the stage of Eurasian watermilfoil (EWM) growth and finalize potential management areas.

EWM plants were generally 2-3 feet tall, depending on water depth, and showing active growth with red apical meristems. Notable growth was observed offshore within Atwater Bay, the shoreline along the end of Ferncliff Road, the slight cove along the fork in Stonehenge Road, and along Cones Point Road. Results of the survey were further communicated to LSCA for their input and final determination on proposed treatment and DASH areas.

2.3 Summary of 2019 Treatment

A total of 38.1 acres amongst five areas were targeted for treatment (Figure 1). Consistent with previous years, each treatment area was evaluated with regards to EWM cover/distribution as well as several other factors including: potential for increased EWM spread; potential for effective treatment; and the overall benefit of milfoil control with respect to the lake, lake residents and other potential users. A final treatment map was provided to VT DEC for review and approval prior to treatment.

Treatment was conducted on Wednesday, July 10, 2019 to allow enough time to comply with the notification requirements of ANC Permit #2770-ANC-C and so that the water-use recommendations would not be imposed over a weekend. Treatment was conducted later in the season than prior years due to issuance of the new ANC Permit to utilize ProcellaCOR herbicide.

Weather conditions on the day of treatment were mostly sunny with an air temperature of 70-80°F; wind was out of the west, estimated at <5 mph. Surface water temperature in the main basin was approximately 27.7°C.

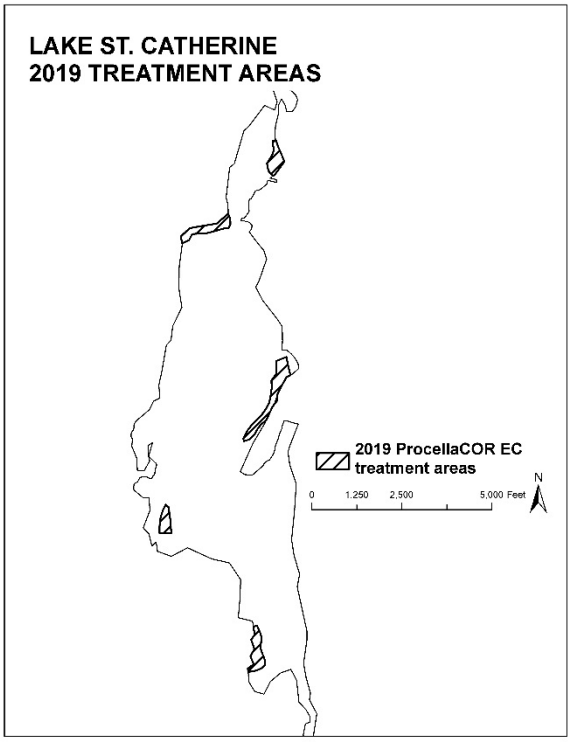


Figure 1. 2019 Treatment Areas

The treatment was conducted with a 20-foot aluminum work skiff. The ProcellaCOR EC herbicide was injected at depth subsurface using hoses that trailed the spray boat. An onboard GPS unit was used to provide real-time guidance and ensure an even application in each of the treated areas. The State boat ramp located on the channel between the Main Lake and Little Lake was used as the base of operations.

The application rate for ProcellaCOR was 3 PDUs/ac-ft (5.79 ppb/ac-ft); a total of 1209 PDUs were applied. The treatment took approximately 3 hours to complete.

2.4 Herbicide Residue Testing

In compliance with conditions of the ANC Permit #2770-ANC-C, water samples were collected from within and immediately downstream of Lake St. Catherine following treatment for analysis of ProcellaCOR concentrations. Sampling was conducted 48 hours following treatment, at which time concentrations at all sample locations were below 1 ppb, which was the water-use recommendation for select irrigation imposed by DEC in correlation with the restrictions on the ProcellaCOR EC label.

A map of the sampling locations is attached in Appendix A. Sampling instructions and sample bottles were provided to LSCA representatives by SŌLitude and SePRO. Collected samples were shipped via overnight delivery to SePRO's laboratory in Whittakers, North Carolina.

Samples were collected on July 12 and consistent with anticipated results, residues dropped quickly with no sample locations above the 1 ppb threshold after 48 hrs. A copy of the results is also attached in Appendix A.

3 LATE SEASON COMPREHENSIVE AQUATIC VEGETATION SURVEY

3.1 Survey Methods

Using methods employed in previous years of this management program, the late season comprehensive aquatic vegetation survey conducted on September 26 and 27. All three lake basins were systematically toured by boat by SŌLitude biologists Amanda Mahaney and Kara Sliwoski. Transect and data point locations established in 2001 were relocated using a Differential GPS system (Appendix B – Figure 1).

Weather conditions the first day were relatively windy, with temperatures in the upper 60s before heavy rain began mid-day; the second day had similar temperatures with overcast conditions and ~5 mph variable winds.

Recorded at each data point was the following information: aquatic plants present, dominant species, plant biomass, percent total plant cover and percent EWM cover. Water depths that were recorded during the pre-treatment survey were verified using a high-resolution depth finder. The plant community was assessed through visual inspection, use of a throw-rake and with an Aqua-Vu underwater camera system. Locations where EWM plants were observed were recorded with a GPS unit. Plants were identified to genus and species level when possible. Plant cover was given a percentage rank based on the areal coverage of plants within an approximate 400 square foot area assessed at each data point. Generally, in areas with 100% cover, bottom sediments could not be seen through the vegetation; percentages less than 100% indicated the amount of bottom area covered by plant growth. The percentage of EWM was also recorded at each data point. In addition to cover percentage, a plant biomass index was assigned at each data point to document the amount of plant growth vertically through the water column. Plant biomass was estimated on a scale of 0-4, as follows:

0 No biomass; plants generally absent
1 Low biomass; plants growing only as a low layer on the sediment
2 Moderate biomass; plants protruding well into the water column but generally not reaching the water surface
3 High biomass; plants filling enough of the water column and/or covering enough of the water surface to be considered a possible recreational nuisance or habitat impairment
4 Extremely high biomass; water column filled and/or surface completely covered, obvious nuisance conditions and habitat impairment severe

Field data and the location for each data point is provided in Appendix B.

3.2 Survey Findings

Quantitative measures of the aquatic plant community documented in 2019 were comparable to some prior years. Lake-wide EWM distribution (FOC - frequency of occurrence) decreased reasonably from 69% in 2018 to 37% this season (Table 2). However, EWM abundance (% cover) only decreased slightly since 2018 from 16% to 11%. Overall vegetative cover also decreased slightly compared to last year, from 70% to 63% this year.

The composition of the vegetative community has also remained relatively unchanged since 2001 and is dominated by native pondweed species, namely (in decreasing FOC): *Potamogeton robbinsii*, *Elodea canadensis*, *Potamogeton illinoensis*, and *Zosterella dubia*. Slight FOC increases in *Ceratophyllum echinatum*, *Elodea canadensis*, *Myriophyllum verticillatum*, *Najas minor*, *Nuphar varigata*, *Potamogeton berchtoldii*, *Potamogeton crispus*, *Potamogeton illinoensis*, *Potamogeton praelongus*, *Potamogeton robbinsii*, *Potamogeton vaseyi*, *Ranunculus aquatilis*, and *Stuckenia pectinata* were observed this year in comparison to last year. Diversity has also been maintained throughout the course of management with 31 different aquatic plant species identified this fall and an average of approximately 4.8 species per point.

Comparative data for all three basins, and overall, collected during late season surveys between 2001 and 2019 is listed below (Table 1).

Table 1. Summary of Annual Survey Data, 2001-2019

LILY POND	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
# of Data Points	24																
Total Plant Cover	90	80	98	88	91	98	94	98	93	94	96	94	90	78	60	99	99
Milfoil Cover	9	6	2	0	2	7	<1	<1	<1	1	5	1.5	2.2	7	6	6.7	9.6
Plant Biomass Index	3.1	2.5	3.3	2.5	2.8	3.3	2.7	2.3	2.9	3.1	3.5	3.4	3.5	3.2	2.9	3.9	3.7
Average Species Richness	5.67	3.58	5.17	3.59	4.54	5.58	4.83	5.46	4.13	4.21	4.46	5.04	4.8	5.5	5.54	7.75	7.04

LAKE ST. CATHERINE (Main Basin)	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
# of Data Points	129																
Total Plant Cover	66	46	51	57	58	66	58	63	59	56	63	63	63	37	43	60	47
Milfoil Cover	43	16	0	4	11	4	5	2	7	8	16	15	7	6	7	16	1.9
Plant Biomass Index	1.9	1.5	1.6	1.8	2	2	2	1.3	1.8	1.5	2	2	2	2.6	1.6	2.9	2.7
Average Species Richness	2.96	2.39	2.85	3.5	3.75	4.09	3.68	3.06	2.88	2.88	2.85	2.87	3.2	3.1	3.35	4.59	3.98

LITTLE LAKE	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
# of Data Points	43																
Total Plant Cover	72	66	78	83	83	77	56	62	76	81	80	86	96	54	49	84	90
Milfoil Cover	15	0	0	2	7	10	<1	5	9	14	7	10	42	25	13	22	41
Plant Biomass Index	2.3	2.1	2.4	2.9	2.8	2.7	2.2	2.7	3.3	2.5	3	3.2	3.8	3.8	2.3	3.9	3.9
Average Species Richness	5.62	3.23	3.3	3.81	4.58	4.3	4.23	4.65	3.84	4.42	4.63	4.77	4.4	4	5.49	6.79	6.26

OVERALL	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
# of Data Points	199																
Total Plant Cover (%)	70	54	63	66	67	73	63	67	67	66	70	72	-	45	46	70	63
Milfoil Cover (%)	49	0.1	0.5	3	9	5	3	3	7	8	13	12	13	10	8	16	11
Plant Biomass Index	2	2	2	2	2	2	2	2	2	2	2	2	-	3	2	3.2	3.1
Average Species Richness	-	-	-	3.57	4.03	4.32	3.94	3.7	3.23	3.38	3.44	3.56	3.71	3.52	4.08	5.45	4.84

Table 2. Entire Lake System – Annual Species List and Frequency of Occurrence (%), 2001-2019

Macrophyte Species (Common Name / Scientific Name)	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Water marigold *Bidens beckii*†	3	0	0	0	0	0	0	0	1	0	0	0.5	0	0	0	0	0
Watershield *Brasenia schreberi*	4	8	7	7	7	6	5	5	5	3	4	4	3	3	3	5	5
Coontail *Ceratophyllum demersum*	20	8	11	12	21	18	17	22	10	21	15	17	15	14	21	24	17
Spineless hornwort *Ceratophyllum echinatum*																	3
Muskgrass / Stonewort *Char asp. / Nitella* sp.	17	6	36	40	14	14	13	2	2	1	0	3	19	5	8	12	3
Spikerush *Eleocharis asicularia*	1	1	1	0	0	0	0	0	0	0	0	0	2	<1	0	0	0
Common waterweed *Elodea canadensis*	32	1	1	1	5	43	60	30	10	14	23	12	30	38	50	61	70
Quillwort *Isoetes sp.*	2	6	2	5	2	3	1	0	1	1	0	0	1	<1	<1	<1	0
Common duckweed *Lemna minor*	7	1	0	1	0	1	1	0	0	0	0	0	<1	<1	<1	0	0
Eurasian watermilfoil *Myriophyllum spicatum*	94	44	17	33	74	65	38	40	43	51	64	54	48	25	62	69	37
Whorled watermilfoil *Myriophyllum verticillatum*													1	0	5	0	<1
Slender naiad *Najas flexilis*	22	0	8	39	34	22	15	16	14	8	4	7	10	9	20	19	17
Thread leaf naiad *Najas gracillima*																5	1
Spiny naiad *Najas minor*	0	0	0	0	0	0	0	0	0	0	0	0	<1	2	0	1	2
Yellow waterlily *Nuphar variegata*	5	5	5	2	2	1	2	1	2	1	1	0	2	<1	13	2	2
White waterlily *Nymphaea odorata*	16	5	11	10	11	11	10	7	7	12	12	14	13	8	1	24	21
Largeleaf pondweed *Potamogeton amplifolius*	33	38	43	49	52	53	51	56	23	35	32	31	13	20	19	23	22
Berchtold's pondweed *Potamogeton berchtoldii*																	4
Curlyleaf pondweed *Potamogeton crispus*	2	1	7	5	3	1	0	0	1	1	0	1	0	<1	1	0	<1
Ribbonleaf pondweed *Potamogeton epihydrus*	2	6	7	3	3	5	1	1	1	4	1	2	<1	1	2	8	7
Leafy Pondweed *Potamogeton foliosus*																12	3
Variable leaf pondweed *Potamogeton gramineus*	23	1	6	6	2	4	4	4	11	8	3	3	4	3	4	14	9
Illinois pondweed *Potamogeton illinoensis*	4	1	2	9	23	39	29	36	35	53	56	57	44	47	50	43	57
Floating leaf pondweed *Potamogeton natans*	0	0	0	9	0	8	8	13	8	0	0	13	0	0	0	<1	0
Whitestem pondweed *Potamogeton praelongus*	0	0	0	0	0	0	0	0	0	<1	<1	3	6	10	<1	5	10
Thinleaf pondweed *Potamogeton pusillus*	0	0	0	5	12	6	5	12	12	5	4	0	14	2	0	12	0
Robbins' pondweed *Potamogeton robbinsii*	52	76	88	74	77	68	84	78	57	76	76	73	57	58	65	69	70

Vasey's pondweed *Potamogeton vaseyi*																	6
Flatstem pondweed *Potamogeton zosteriformis*	28	3	29	29	23	19	16	26	22	20	23	36	15	16	15	31	20
White water crowfoot *Ranunculus aquatilis*															2	0	2
Sago pondweed *Stuckenia pectinata*																	2
Humped bladderwort *Utricularia gibba*	2	0	1	5	1	1	4	1	0	0	0	0	2	5	5	5	2
Flat leaf bladderwort *Utricularia intermedia*																3	1
Purple bladderwort *Utricularia purpurea*																8	0
Common bladderwort *Utricularia vulgaris*	8	9	2	6	7	7	11	8	2	4	4	7	7	4	10	13	13
Tapegrass *Vallisneria americana*	29	13	2	4	9	8	15	15	14	15	18	19	26	21	24	34	34
Watermeal *Wolffia* sp.	0	0	0	5	4	0	0	0	0	0	0	0	0	0	0	0	0
Water stargrass *Zosterella dubia*	1	1	9	8	23	17	7	13	4	2	4	11	15	19	20	38	37

†Formerly listed as *Megalodonta beckii* in previous years' reports.

3.3 Lily Pond

Annual increases in EWM frequency of occurrence in Lily Pond have been observed, as treatment has not been conducted within this basin since 2014. There was a significant decrease in EWM FOC and a slight increase in percent cover within Lily Pond since last year (Chart 1, Figure 2). Overall, EWM is expanding within Lily Pond, however it is outside of the survey points.

Both plant biomass and average species richness values within Lily Pond remained similar to prior years' data, with healthy and plentiful native species.

Potamogeton robbinsii (96%) remained the most abundant plant in the basin followed by *Elodea canadensis* (92%), *Ceratophyllum demersum (75%)*, *Nymphaea odorata (67%)*, *Utricularia vulgaris (63%)*, *Potamogeton zosteriformis* (54%), and *Zosterella dubia* (50%) (Table 3). All other species' FOC was similar to that of previous years, with a few species showing slight increases or decreases.

Chart 1: Lily Pond - EWM Frequency of Occurrence and Percent Cover

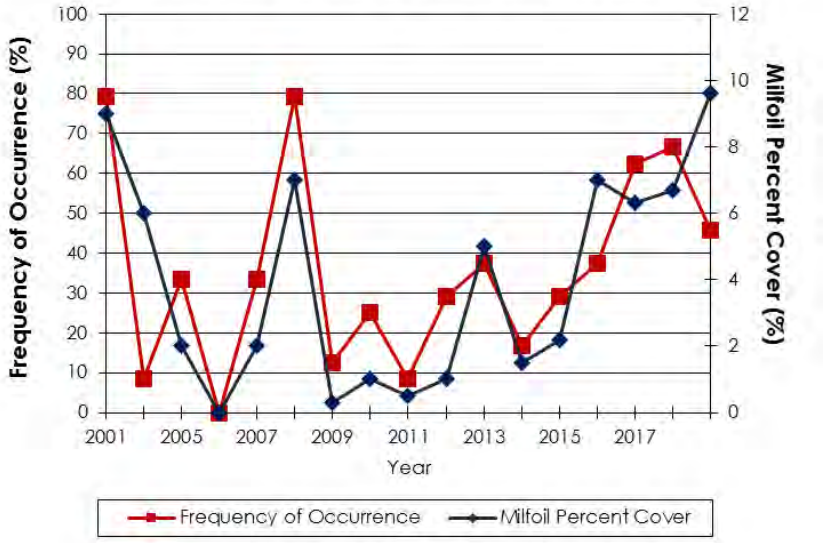


Figure 2: Lily Pond - Fall 2019 EWM distribution

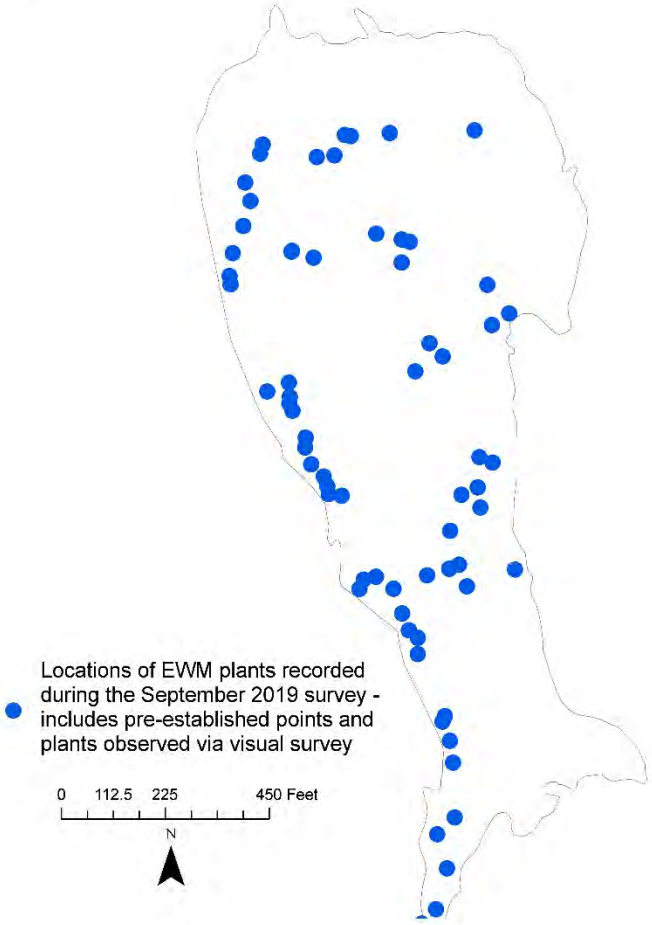


Table 3. Lily Pond – Annual Species List and Frequency of Occurrence (%), 2001-2019

Macrophyte Species (Common Name / Scientific Name)	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Watershield *Brasenia schreberi*	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coontail *Ceratophyllum demersum*	71	4	50	46	83	83	83	79	75	63	67	54	64	67	67	92	75
Spineless hornwort *Ceratophyllum echinatum*																	13
Muskgrass / Stonewort *Chara* sp. / *Nitella* sp.	0	0	0	5	4	0	0	0	0	0	0	0	0	0	4	0	0
Common waterweed *Elodea canadensis*	29	0	8	0	8	29	46	79	17	29	17	13	48	63	83	88	92
Quillwort *Isoetes* sp.	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Common duckweed *Lemna minor*	46	8	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0
Eurasian watermilfoil *Myriophyllum spicatum*	79	8	33	0	33	79	13	25	8	29	42	17	28	38	63	67	46
Whorled watermilfoil *Myriophyllum verticillatum*																	4
Slender naiad *Najas flexilis*	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Yellow waterlily *Nuphar variegatum*	17	17	17	0	0	0	0	4	4	0	0	0	0	0	0	0	0
White waterlily *Nymphaea odorata*	63	17	29	9	21	25	33	17	25	29	38	38	28	33	42	71	67
Largeleaf pondweed *Potamogeton amplifolius*	33	100	92	77	79	88	92	88	38	46	75	75	24	50	38	54	42
Curlyleaf pondweed *Potamogeton crispus*	4	4	4	5	13	0	0	0	4	0	0	0	0	0	0	0	4
Ribbonleaf pondweed *Potamogeton epihydrus*	0	13	4	0	4	4	4	0	4	4	0	0	0	4	0	8	0
Variable leaf pondweed *Potamogeton gramineus*	17	0	8	0	4	0	8	0	8	8	0	0	0	0	0	0	0
Illinois pondweed *Potamogeton illinoensis*	0	4	8	9	46	42	25	17	46	42	46	54	16	46	33	29	38
Floating leaf pondweed *Potamogeton natans*	0	0	0	9	0	8	8	13	8	0	0	13	0	0	0	4	0
Whitestem pondweed *Potamogeton praelongus*																17	46
Thinleaf pondweed *Potamogeton pusillus*																4	0
Robbins' pondweed *Potamogeton robbinsii*	96	92	96	96	92	88	96	96	86	96	100	100	68	71	92	100	96
Flatstem pondweed *Potamogeton zosteriformis*	58	8	63	0	25	46	13	67	46	33	29	67	48	46	33	79	54
Humped bladderwort *Utricularia gibba*	0	0	0	41	0	0	4	0	0	0	0	0	12	25	8	0	0
Purple bladderwort *Utricularia purpurea*																17	0
Common bladderwort *Utricularia vulgaris*	29	38	0	27	4	13	17	4	17	21	17	29	28	29	50	67	63
Tapegrass *Vallisneria americana*	33	46	0	0	0	0	8	4	4	0	0	0	4	38	0	8	4
Watermeal *Wolffia* sp.	0	0	0	5	4	0	0	0	0	0	0	0	0	0	0	0	0
Water stargrass *Zosterella dubia*	4	0	38	0	25	21	8	50	0	0	0	17	40	58	29	63	50

3.4 Lake St. Catherine (Main Basin)

The Main Basin of Lake St. Catherine has shown slight fluctuations in native plant species distribution and composition through the years of management. Observed at 64% of the survey points *Elodea canadensis* was the most common plant species in the Main Basin. In decreasing FOC, the following species were also prevalent in this basin: *Potamogeton illinoensis*, *Potamogeton robbinsii*, *Zosterella dubia* and *Vallisneria americana*. All other species observed showed FOC values that were similar to last year with <±10% change (Table 4).

EWM distribution decreased significantly from 62% to 15% over last year's FOC and percent EWM cover decreased to 2%, at survey points within the Main Basin.

EWM control was excellent throughout treatment areas, with only other areas in the basin having any observed growth, most of which were at lower densities (Figure 3). This year's spot-treatments and DASH efforts were exceptionally effective but can only provide control to those areas while some EWM growth remains elsewhere in the basin.

Locations of EWM observed during the survey, in addition to those survey points where observed, were recorded with a GPS unit. All EWM points observed during the September 2019 survey are depicted in Figure 3.

Chart 2 (below) illustrates the year-to-year change in EWM frequency of occurrence and percent cover in the Main Basin.

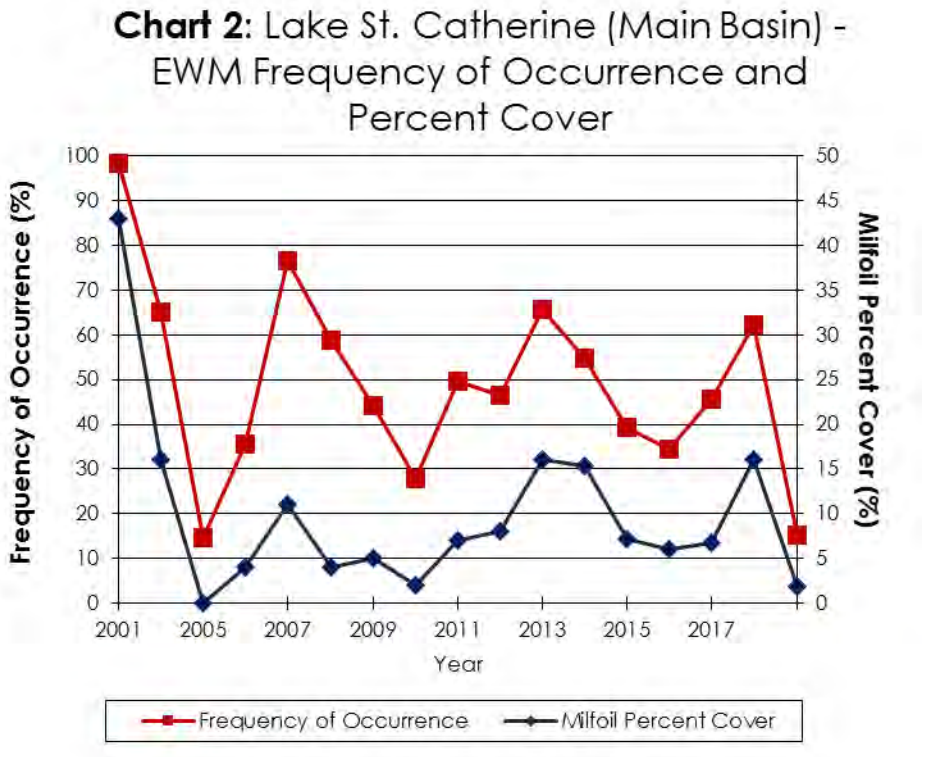


Figure 3: Main Basin - Fall 2019 EWM distribution

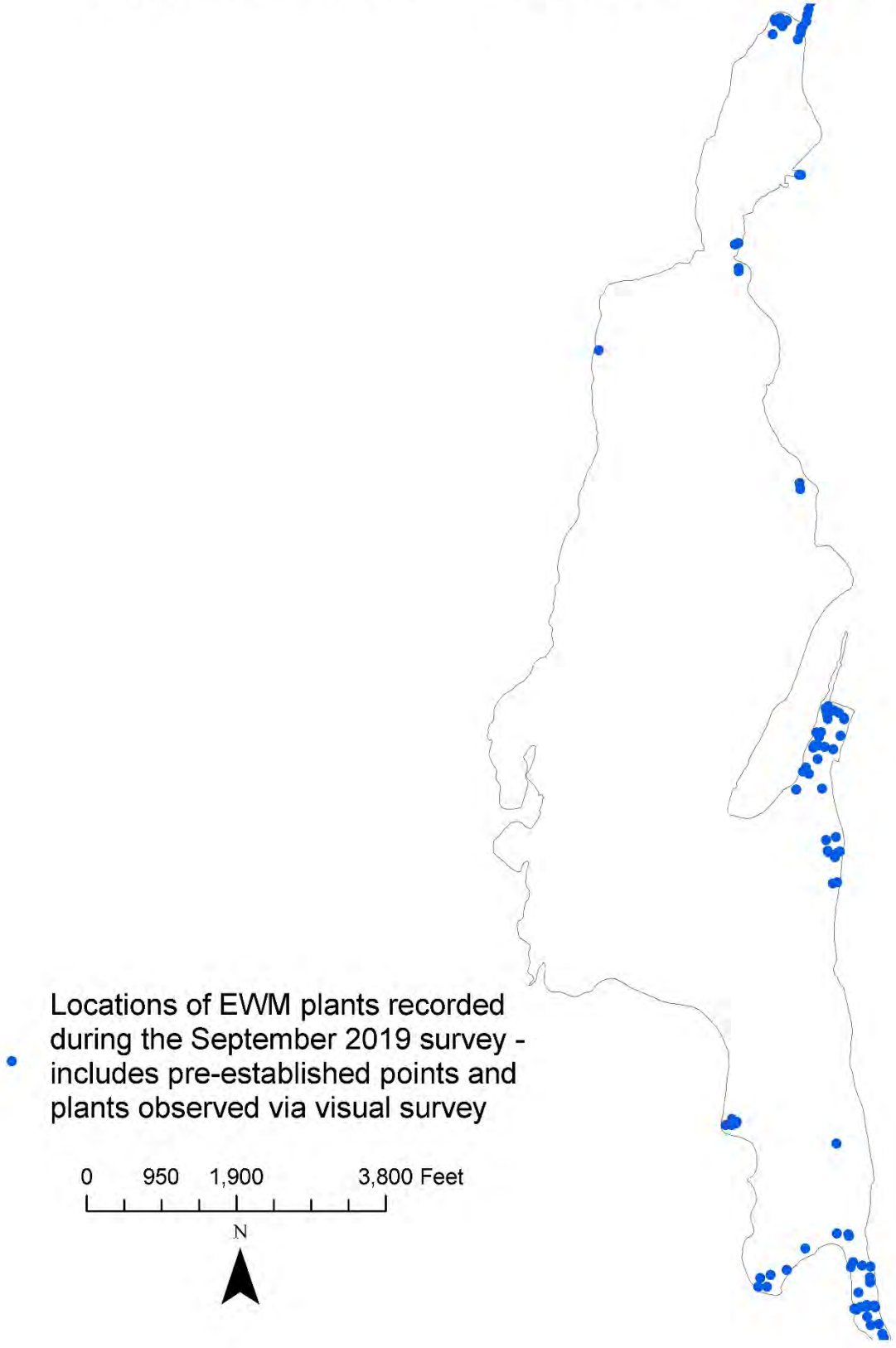


Table 4: Lake St. Catherine (Main Basin) – Annual Species List and Frequency of Occurrence (%), 2001-2019

Macrophyte Species (Common Name / Scientific Name)	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Water marigold *Bidens beckii*†	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Watershield *Brasenia schreberi*	0	<1	<1	2	2	2	2	2	2	<1	<1	2	3	3	2	5	2
Coontail *Ceratophyllum demersum*	11	11	6	7	11	10	8	14	6	11	2	5	3	5	5	6	2
Spinless hornwort *Ceratophyllum echinatum*																	1
Muskgrass / Stonewort *Chara* sp. / *Nitella* sp.	2	17	62	57	21	22	19	2	<1	0	0	5	16	9	11	14	5
Common waterweed *Elodea canadensis*	28	0	0	<1	5	52	71	15	9	7	19	7	30	37	45	58	64
Quillwort *Isoetes* sp.	2	9	<1	6	2	5	0	0	<1	<1	0	0	2	0	<1	<1	0
Common duckweed *Lemna minor*	2	0	0	0	0	<1	<1	0	0	0	0	0	<1	0	0	0	0
Eurasian watermilfoil *Myriophyllum spicatum*	98	65	15	36	77	59	44	28	50	47	66	56	39	34	46	62	15
Slender naiad *Najas flexilis*	19	0	12	57	50	34	22	25	20	12	6	6	16	2	28	25	24
Thread leaf naiad *Najas gracillima*																8	2
Brittle naiad *Najas minor*																2	2
Yellow waterlily *Nuphar variegata*	<1	0	0	<1	<1	0	0	<1	<1	0	0	0	0	0	2	0	1
White waterlily *Nymphaea odorata*	3	2	2	3	3	3	3	2	2	2	<1	2	5	2	0	8	5
Largeleaf pondweed *Potamogeton amplifolius*	29	15	26	34	39	38	41	44	26	35	27	25	12	12	18	15	17
Berchtold's pondweed *Potamogeton berchtoldii*																	5
Curlyleaf pondweed *Potamogeton crispus*	2	0	9	5	2	<1	0	0	0	0	0	<1	0	0	<1	0	0
Ribbonleaf pondweed *Potamogeton epihydrus*	2	3	5	2	<1	4	<1	<1	<1	2	0	2	0	0	<1	4	5
Leafy pondweed *Potamogeton foliosus*																17	4
Variable leaf pondweed *Potamogeton gramineus*	18	0	5	2	2	6	3	6	15	9	3	4	6	4	5	21	14
Illinois pondweed *Potamogeton illinoensis*	6	<1	<1	9	16	34	23	31	33	53	57	56	40	38	52	34	60
Whitestem pondweed *Potamogeton praelongus*																4	5
Thinleaf pondweed *Potamogeton pusillus*	0	0	0	5	12	6	5	12	12	5	4	0	14	2	0	17	0
Robbins' pondweed *Potamogeton robbinsii*	31	65	82	62	67	58	78	73	58	67	66	61	49	47	44	58	57
Vasey's pondweed *Potamogeton vaseyi*																	8
Flatstem pondweed *Potamogeton zosteriformis*	24	2	31	42	28	19	19	23	30	20	20	32	10	4	10	23	11
White water crowfoot *Ranunculus aquatilis*																	2
Sago pondweed *Stuckenia pectinata*																	3

Common bladderwort *Utricularia vulgaris*	<1	<1	<1	0	0	2	<1	3	0	<1	0	<1	<1	<1	2	2	3
Tapegrass *Vallisneria americana*	14	3	<1	3	9	9	13	13	10	9	15	14	23	20	19	31	33
Water stargrass *Zosterella dubia*		<3	5	12	28	22	8	9	5	2	2	13	13	24	21	32	42

†Formerly listed as ***Megalodonta beckii*** in previous years' reports.

3.5 Little Lake

Overall plant cover within Little Lake saw a continued increase from 84% in 2018 to 90% this year. Twenty (20) species were observed within this basin this year, compared to nineteen (19) last year. Little Lake's consistent, shallow depth (6-foot average), allows for such a diverse plant community, but also allows for plant growth to dominate the entire water column, likely hindering recreational uses of the basin. Additionally, average species richness decreased by ~0.5 species per point compared to 2018.

EWM distribution increased to 100% of survey points, while EWM percent cover increased to ~41% (Figure 4, Table 5, Chart 3). However, as herbicide treatment or DASH are not conducted within Little Lake, but mechanical harvesting is, this increase was anticipated.

The most commonly observed species, in decreasing order, were as follows: ***Myriophyllum spicatum***, ***Potamogeton robbinsii***, ***Elodea canadensis***, ***Potamogeton illinoensis***, ***Vallisneria americana***, and ***Nymphaea odorata*** (Table 5). A notable decrease in ***Zosterella dubia*** was also observed this year after last year's significant increase.

Chart 3: Little Lake - EWM Frequency of Occurrence and Percent Cover

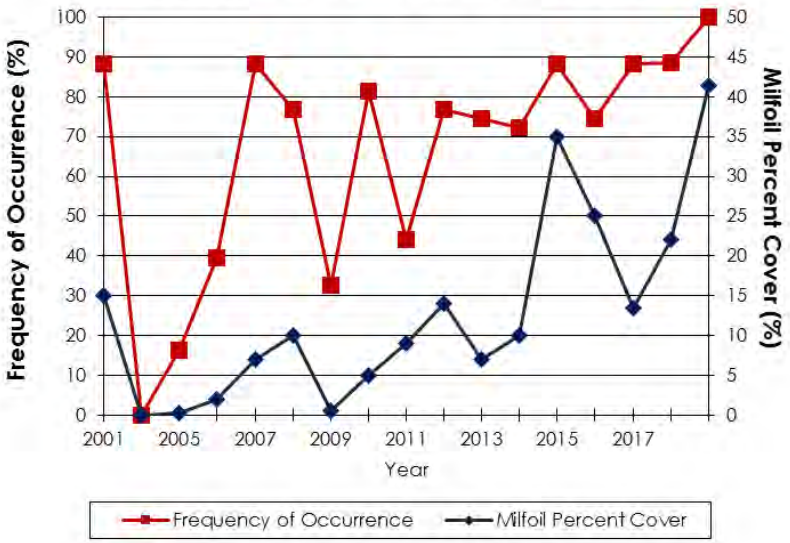


Figure 4: Little Lake - Fall 2019 EWM distribution

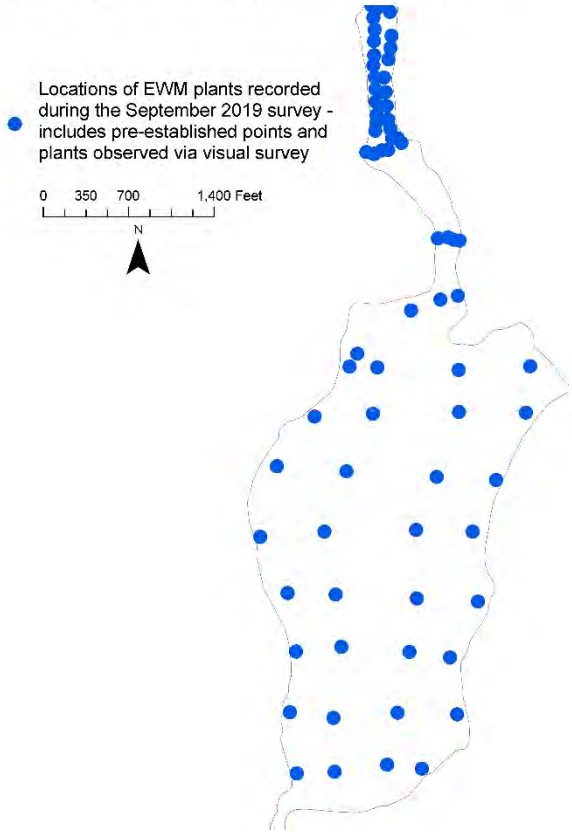


Table 5: Little Lake – Annual Species List and Frequency of Occurrence (%), 2001-2019

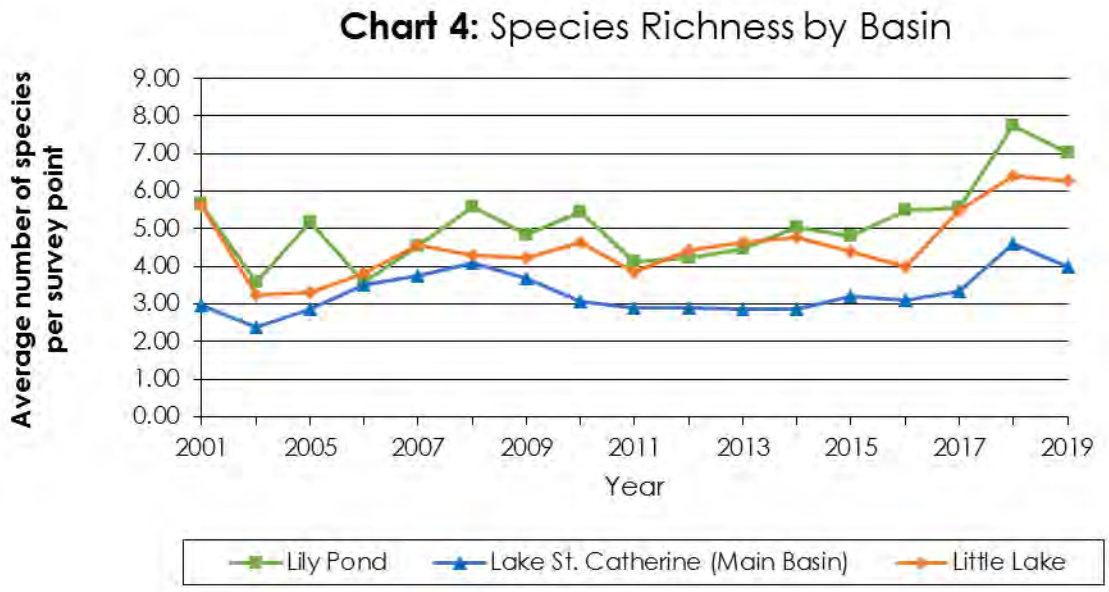
Macrophyte Species (Common Name / Scientific Name)	2001	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Water marigold *Bidens beckii*†	7	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
Watershield *Brasenia schreberi*	14	30	30	23	26	21	14	12	14	12	14	12	2	2	5	7	21
Muskgrass / Stonewort *Chara sp. / Nitella sp.*	7	5	7	12	0	0	2	0	5	2	0	0	2	0	0	12	0
Coontail *Ceratophyllum demersum*	21	0	2	9	16	7	9	16	28	28	28	35	23	14	44	40	30
Spinless hornwort *Ceratophyllum echinatum*																	2
Spikerush *Eleocharis sp.*	5	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Common waterweed *Elodea canadensis*	47	5	0	0	2	23	40	47	21	28	40	26	28	28	74	54	74
Quillwort *Isoetes sp.*	0	0	5	2	0	0	2	0	0	2	0	0	0	0	0	0	0
Eurasian watermilfoil *Myriophyllum spicatum*	88	0	16	40	88	77	32	81	44	77	74	72	86	74	88	88	100
Whorled watermilfoil *Myriophyllum verticillatum*													4	0	5	0	0
Slender naiad *Najas flexilis*	40	0	0	5	2	0	5	0	5	0	2	14	0	2	7	9	5
Yellow waterlily *Nuphar variegatum*	9	14	12	7	7	2	7	2	5	2	2	0	7	5	5	9	5
White waterlily *Nymphaea odorata*	30	9	26	30	28	10	19	19	23	32	30	37	27	12	42	44	44
Largeleaf pondweed *Potamogeton amplifolius*	44	72	70	77	74	77	56	72	28	30	21	23	14	28	12	26	28
Berchtold's pondweed *Potamogeton berchtoldii*																	2
Curlyleaf pondweed *Potamogeton crispus*	0	0	0	2	0	0	0	0	0	2	0	0	0	0	2	0	0
Ribbonleaf pondweed *Potamogeton epihydrus*	0	12	14	7	7	7	0	0	2	9	2	2	2	2	5	21	19
Variable leaf pondweed *Potamogeton gramineus*	42	5	9	23	0	0	5	0	5	5	2	0	0	0	2	0	0
Illinois pondweed *Potamogeton illinoensis*	0	0	0	9	33	47	49	36	62	61	61	65	71	72	51	61	58
Whitestem pondweed *Potamogeton praelongus*																	5
Thinleaf pondweed *Potamogeton pusillus*	0	0	0	2	7	2	0	0	0	0	0	0	2	0	0	0	0
Robbins' pondweed *Potamogeton robbinsii*	88	100	100	100	100	88	95	81	86	91	93	95	73	86	86	81	86
Flatstem pondweed *Potamogeton zosteriformis*	23	2	5	5	7	5	7	9	9	14	28	33	11	19	19	30	30
White water crowfoot *Ranunculus aquatilis*															2	0	0
Humped bladderwort *Utricularia gibba*	7	0	2	0	5	2	14	5	0	0	0	0	2	7	16	21	9
Flat leaf bladderwort *Utricularia intermedia*																12	5
Purple bladderwort *Utricularia purpurea*																26	0
Common bladderwort *Utricularia vulgaris*	16	19	7	12	30	19	35	26	5	2	9	14	14	0	11	14	14

Tapegrass *Vallisneria americana*	72	26	7	9	14	9	26	26	35	40	40	44	50	35	0	58	54
Water stargrass *Zosterella dubia*	2	2	5	0	7	2	5	5	2	5	14	2	9	9	9	42	14

†Formerly listed as ***Megalodonta beckii*** in previous years' reports.

3.6 Species Richness

In all three basins, species richness decreased compared to last year with an overall average of approximately 4.8 species per point (Table 1, Chart 4). Each basin's slight decrease is likely related to seasonal variation in growth of plant species. Overall, species richness or native plant diversity in Lily Pond or the Main Basin does not appear to be impacted adversely by the herbicide spot-treatments or other EWM management activities, while Little Lake's harvesting efforts are likely reducing native plant diversity in tandem with the overall increase of EWM there.



4 SUMMARY OF 2019 AQUATIC VEGETATION MANAGEMENT PROGRAM

4.1 ProcellaCOR Herbicide Treatment

Results of the 2019 ProcellaCOR herbicide treatment program at Lake St. Catherine were extremely favorable with no regrowth being observed in any of the treatment areas. As with previous years' treatments utilizing Renovate herbicide, the full extent of treatment success will not be realized until regrowth can be observed next season, if any.

Although Lake St. Catherine had seen primarily good success in utilizing Renovate herbicide in previous management years, this year's EWM control from using ProcellaCOR herbicide was encouraging and supported the decision in change of herbicide technology from Renovate and further confirms ProcellaCOR's future importance as part of an integrated management program.

Species richness and frequency of occurrence indices have fluctuated within each basin over time. However, no major plant composition changes were observed as a result of this year's ProcellaCOR treatment; trends will continued to be monitored through future management years. Based on data collected within the Lake St. Catherine system, as well as other large Vermont waterbodies, seasonal variability and limitations of the data point survey methodology are likely the primary factors responsible for changes in the measurable indices that have been observed year over year.

4.2 Spread Prevention and Non-Chemical Control Activities

As required by the ANC Permit, non-chemical milfoil control activities continued at Lake St. Catherine during the 2019 season. Efforts included volunteer monitoring, boat ramp greeter program, diver assisted suction harvesting and other educational efforts. Details of the non-chemical control efforts will be provided by LSCA under separate cover.

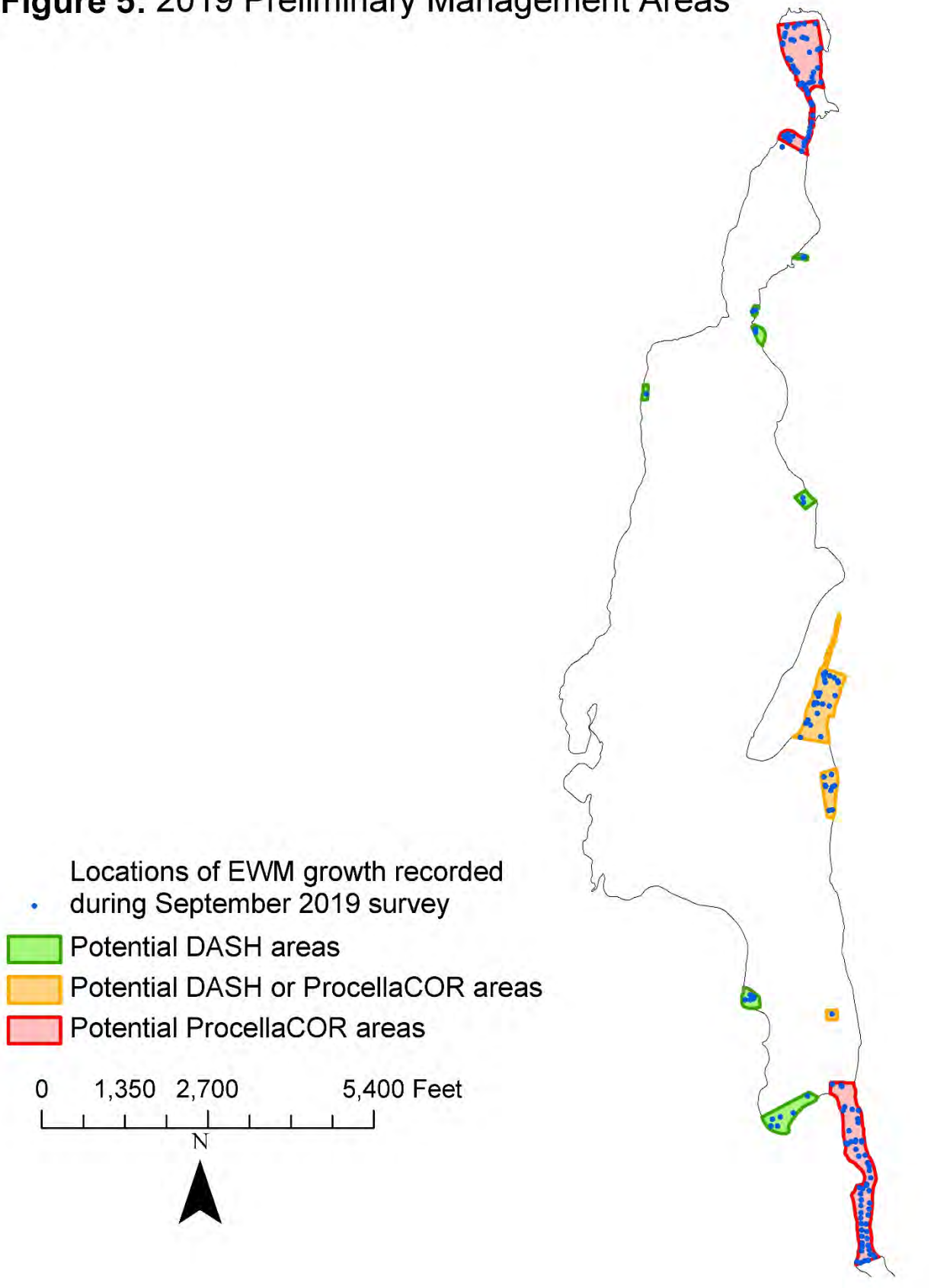
5 RECOMMENDATIONS FOR 2020 SEASON

Controlling areas of dense EWM growth and maintaining it at non-nuisance levels has been the focus of recent EWM management efforts at Lake St. Catherine. The ProcellaCOR herbicide treatment this year effectively and selectively controlled EWM where used. Unlike Renovate, ProcellaCOR is less limited in open water or small treatment area situations where dilution is higher and concentration-exposure-time (CET) may be decreased, as it needs significantly less CET than Renovate; this will ultimately provide better control in those more challenging areas of EWM growth in Lake St. Catherine that may have seen mixed results when utilizing Renovate.

This year's ProcellaCOR herbicide treatment of areas that had not been treated for a few years, coupled with the focused DASH efforts proved to be successful in significantly reducing EWM frequency of occurrence and percent cover in the Main Basin.

As such, for 2020 we are recommending treatment with ProcellaCOR using a similar management approach as was used this year and in past years with Renovate. Based on the results of the September 2019 survey, preliminary 2020 management areas are illustrated on the following page (Figure 5). Using the EWM distribution and density observed this fall, treatment in 2020 is anticipated to be reduced within the Main Basin in comparison to previous years. Most concerning is the significant increase overall of EWM in the channel extending both from the State boat ramp to the Main Basin as well as towards Little Lake; this increase is likely a result of boat traffic traveling from Little Lake into the Main Basin. This area is highly recommended for treatment to prevent further spread of EWM into the Main Basin from boat traffic. Consistent with previous years, potential treatment areas will be inspected in the early spring and treatment areas will be finalized in coordination with the LSCA and VT DEC prior to conducting treatment in 2020.

Figure 5: 2019 Preliminary Management Areas



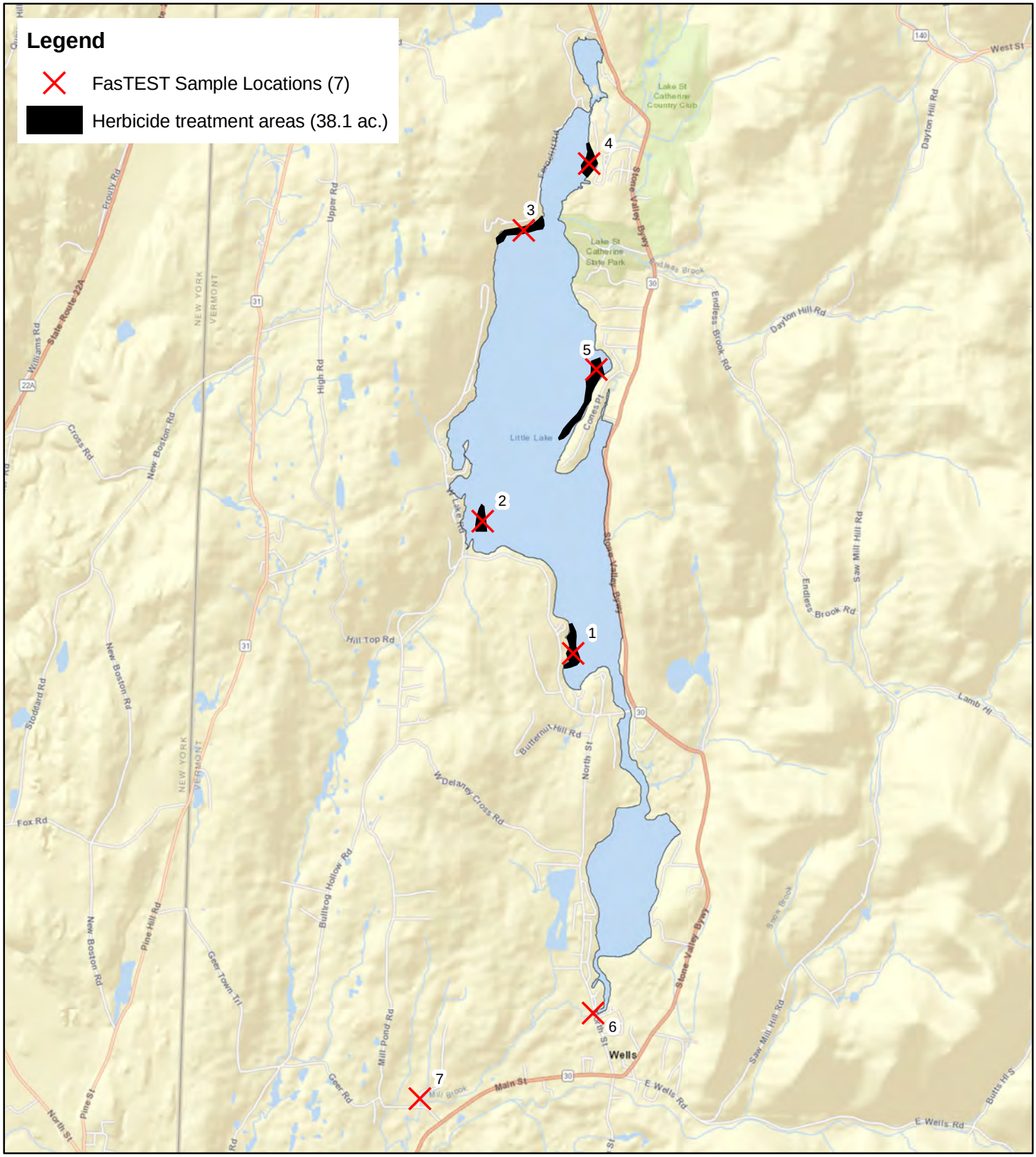
APPENDIX A

Herbicide Residue Testing Results

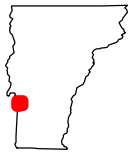
- FasTEST Sampling Location Map
- SePRO Laboratory Report – 07/12/19

2019 FasTEST Sample Locations

SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Lake St. Catherine
Wells / Poultney, VT
Rutland County
43.4657° N, 73.2146° W



Lake St. Catherine

0 4,100 8,200 Feet

1:45,000

Map Date: 05/31/19
Prepared by: KS
Office: SHREWSBURY, MA

SePRO Research & Technology Campus

FasTEST*

16013 Watson Seed Farm Road, Whitakers, NC 27891

Chain of Custody: COC5538 **LABORATORY REPORT**

Customer Company **Customer Contact**

Company Name SOLitude Lake Management	Contact Person: Kara Sliwoski
Address: 1320 Brookwood Drive, Ste. H Little Rock, AR 72202	E-mail Address: ksliwoski@solitudelake.com
	Phone: 508.885.0101

Waterbody Information

Waterbody:	Lake St. Catherine - VT
Waterbody size:	1100
Depth Average:	25

Sample ID	Sample Location	Test	Method	Results	Sampling Date / Time
CTM17020-1	1	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	07/12/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM17021-1	2	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	07/12/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM17022-1	3	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	07/12/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM17023-1	4	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	07/12/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM17024-1	5	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	07/12/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM17025-1	6	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	07/12/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	
CTM17026-1	7	ProcellaCOR/florpyrauxifen-benzyl (ug/L)	FAST 16	<1	07/12/2019
		ProcellaCOR acid/florpyrauxifen (ug/L)	FAST 16	<1	

ANALYSIS STATEMENTS:
SAMPLE RECEIPT /HOLDING TIMES: All samples arrived in an acceptable condition and were analyzed within prescribed holding times in accordance with the SRTC Laboratory Sample Receipt Policy unless otherwise noted in the report.
PRESERVATION: Samples requiring preservation were verified prior to sample analysis and any qualifiers will be

noted
in the report.
QA/QC CRITERIA: All analyses met method criteria, except as noted in the report with data qualifiers.
COMMENTS: No significant observations were made unless noted in the report.
MEASUREMENT UNCERTAINTY: Uncertainty of measurement has been determined and is available upon request.

Laboratory Information
Date / Time Received: 07/15/19 11:00 AM
Date Results Sent: Thursday, July 18, 2019

This entire report was reviewed and approved for release.

Reviewed By: Laboratory Supervisor

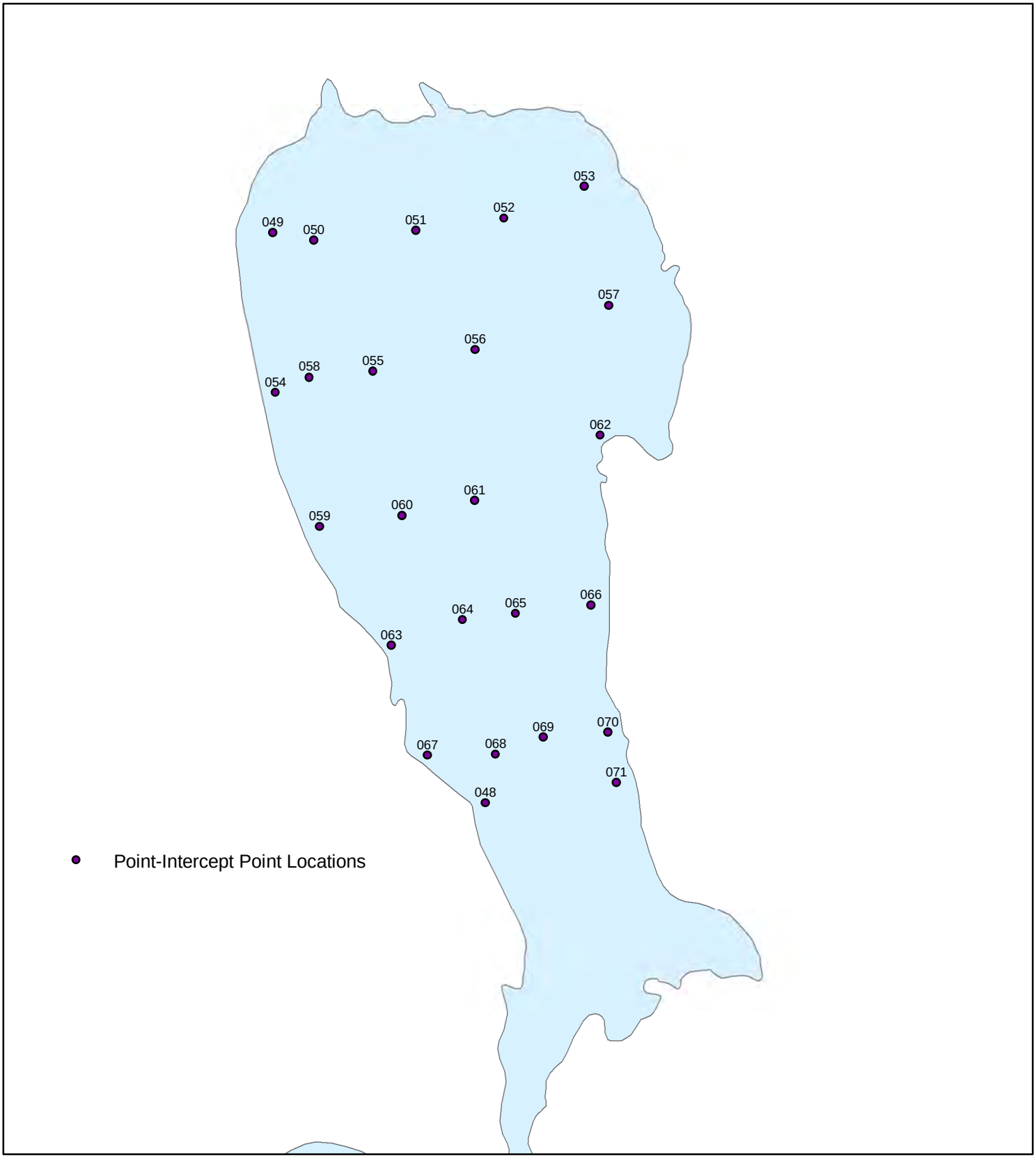
APPENDIX B

Comprehensive Aquatic Vegetation Survey Information

- Survey Point Location Maps
- 2019 Total Vegetation Biomass
- Fall 2019 Native Vegetation Distribution Maps
- Fall 2019 Eurasian Watermilfoil Distribution Map
- Field Data Tables

Lily Pond - Survey Point Locations

SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Lake St. Catherine
Wells / Poultney, VT
Rutland County
43.4657° N, 73.2146° W

Lake St. Catherine

0 250 500 Feet

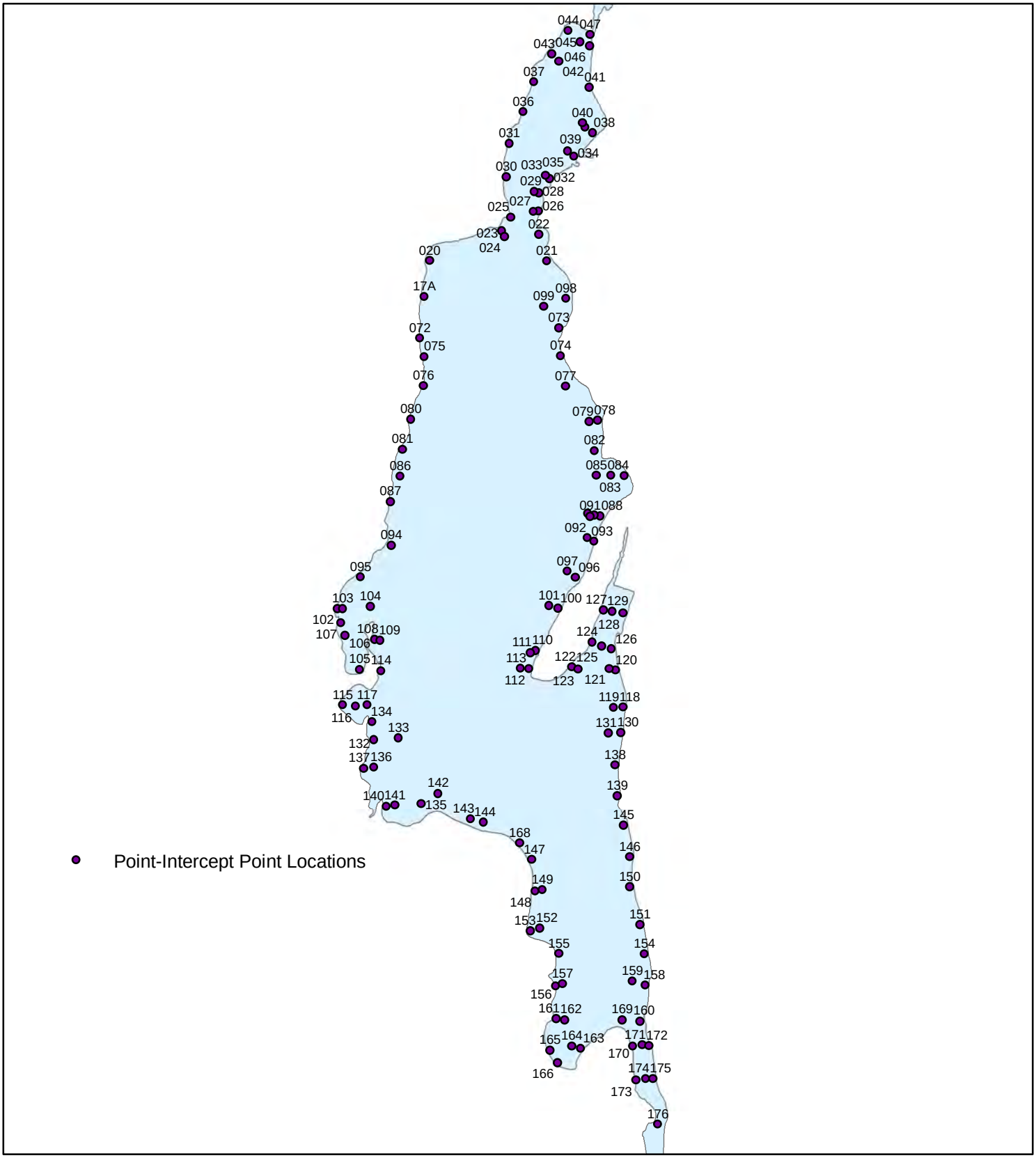
N

1:3,000

Map Date: 10/28/19
Prepared by: KS
Office: SHREWSBURY, MA

Main Basin - Survey Point Locations

SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Lake St. Catherine
Wells / Poultney, VT
Rutland County
43.4657° N, 73.2146° W

Lake St. Catherine

0 2,000 4,000 Feet

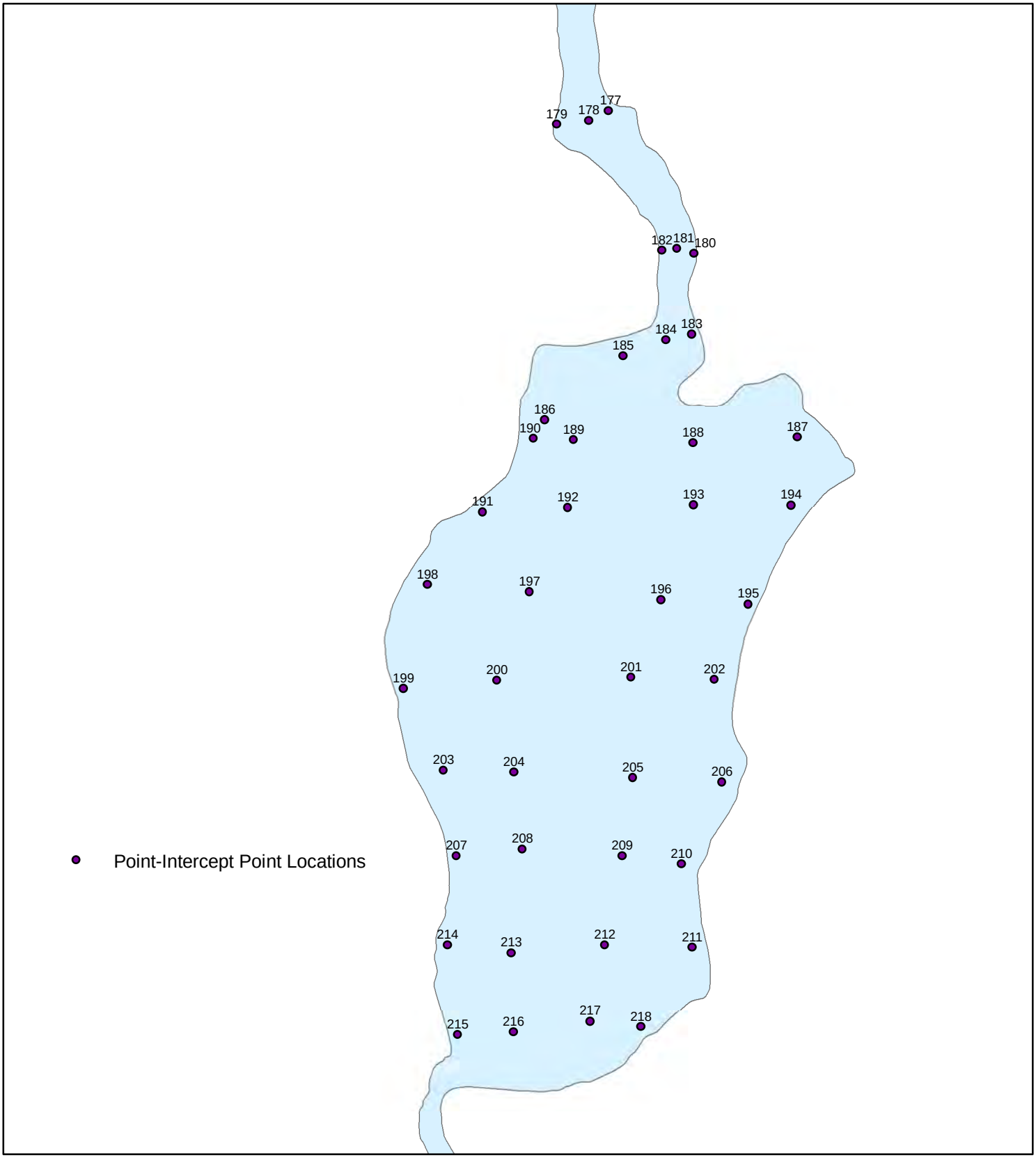
N

1:25,000

Map Date: 10/28/19
Prepared by: KS
Office: SHREWSBURY, MA

Little Lake - Survey Point Locations

SOLITUDE LAKE MANAGEMENT
888.480.5253
solitudelakemanagement.com



Lake St. Catherine
Wells / Poultney, VT
Rutland County
43.4657° N, 73.2146° W

Lake St. Catherine

0 650 1,300 Feet

1:9,000

N

Map Date: 10/28/19
Prepared by: KS
Office: SHREWSBURY, MA

2019 Total Vegetation Biomass

SOLITUDE LAKE MANAGEMENT
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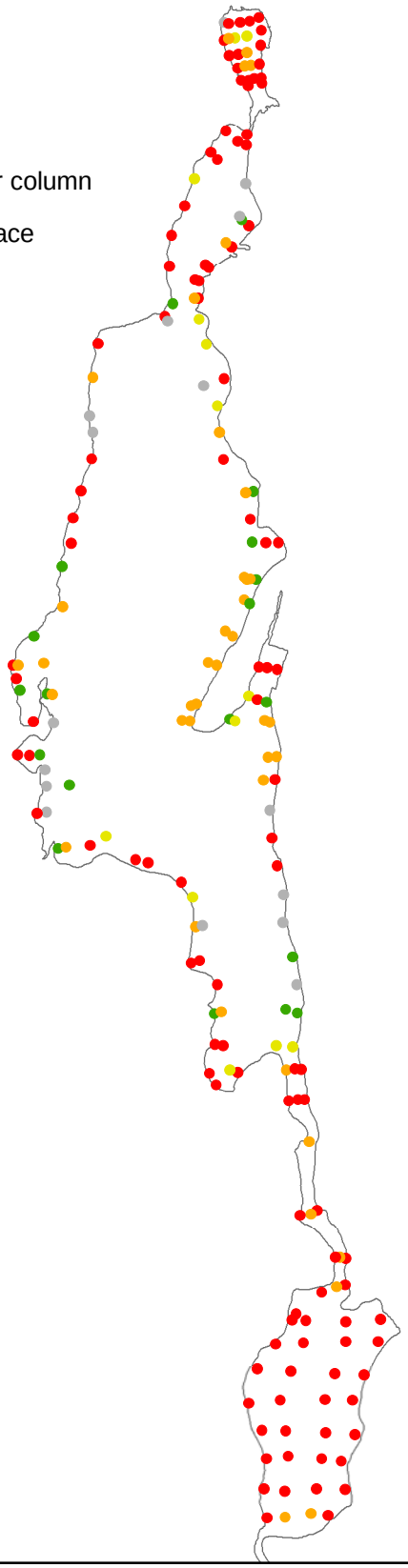
Legend

- 0 - No plant growth
- 1 - Very low plant growth
- 2 - Plant growth extending into water column
- 3 - Plant growth extending near surface
- 4 - Plant growth at surface



Lake St. Catherine
Wells / Poultney, VT
Rutland County
43.4657° N, 73.2146° W

Lake St. Catherine

0 3,000 6,000 Feet

1:37,000

N

Map Date: 10/28/19
Prepared by: KS
Office: SHREWSBURY, MA

Fall 2019 Native Vegetation Distribution (1 of 8)

SOLITUDE LAKE MANAGEMENT
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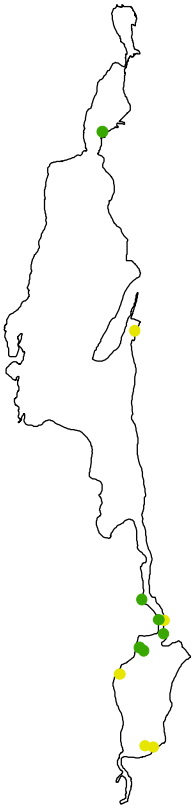
Brasenia schreberi



- Trace
- Sparse
- Moderate
- Dense

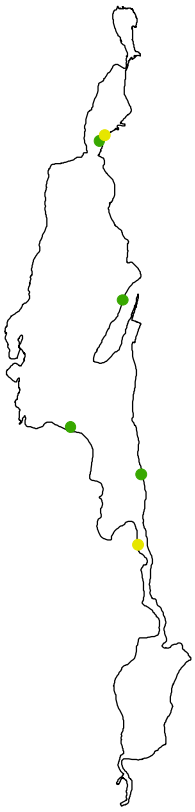
Ceratophyllum demersum

- Trace
- Sparse
- Moderate
- Dense

Ceratophyllum echinatum

- Trace
- Sparse
- Moderate
- Dense

Chara sp. / Nitella sp.



- Trace
- Sparse
- Moderate
- Dense

Lake St. Catherine
Wells / Poultney, VT
Rutland County
43.4657° N, 73.2146° W

Lake St. Catherine

0 6,000 12,000 Feet

1:79,000

N

Map Date: 10/28/19
Prepared by: KS
Office: Shrewsbury, MA

Fall 2019 Native Vegetation Distribution (2 of 8)

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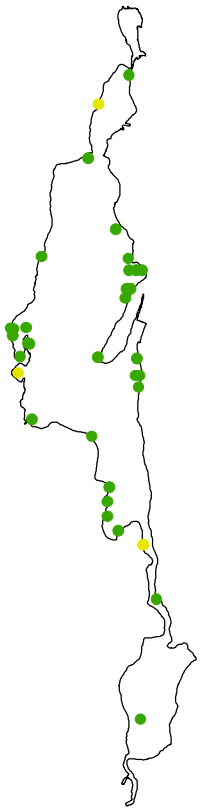
Elodea canadensis

- Trace
- Sparse
- Moderate
- Dense

Myriophyllum verticillatum

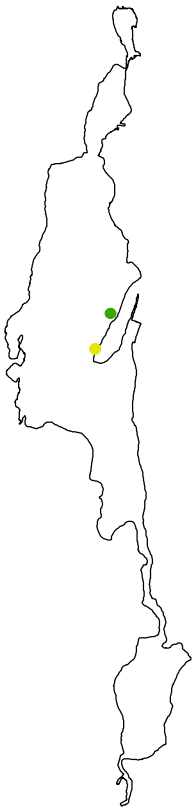
- Trace
- Sparse
- Moderate
- Dense

Najas flexilis



- Trace
- Sparse
- Moderate
- Dense

Najas gracillima



- Trace
- Sparse
- Moderate
- Dense

Lake St. Catherine
Wells / Poultney, VT
Rutland County
43.4657° N, 73.2146° W

Lake St. Catherine

0 6,000 12,000 Feet

1:79,000

N

Map Date: 10/28/19
Prepared by: KS
Office: Shrewsbury, MA

Fall 2019 Native Vegetation Distribution (3 of 8)

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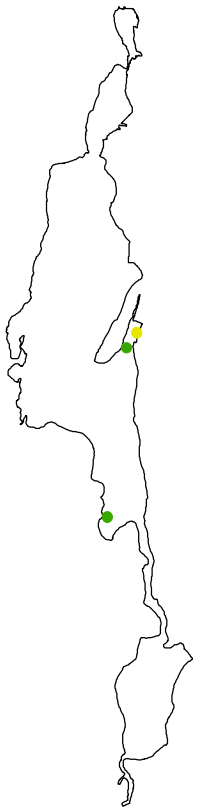
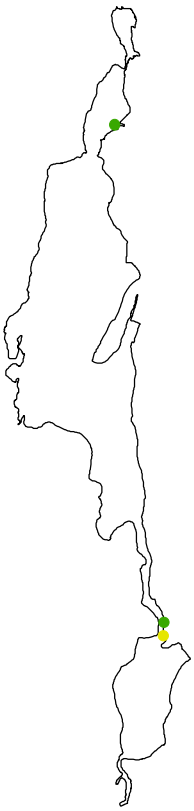
Najas minor



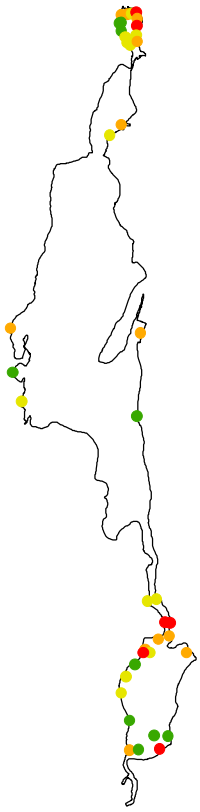
- Trace
- Sparse
- Moderate
- Dense

Nuphar variegata



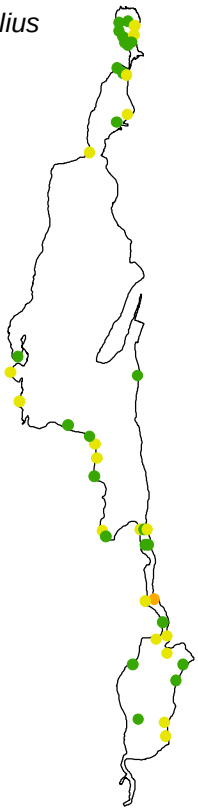
- Trace
- Sparse
- Moderate
- Dense

Nymphaea odorata



- Trace
- Sparse
- Moderate
- Dense

Potamogeton amplifolius



- Trace
- Sparse
- Moderate
- Dense

Lake St. Catherine
Wells / Poultney, VT
Rutland County
43.4657° N, 73.2146° W

Lake St. Catherine

0 6,000 12,000 Feet

1:79,000

N

Map Date: 10/28/19
Prepared by: KS
Office: Shrewsbury, MA

Fall 2019 Native Vegetation Distribution (4 of 8)

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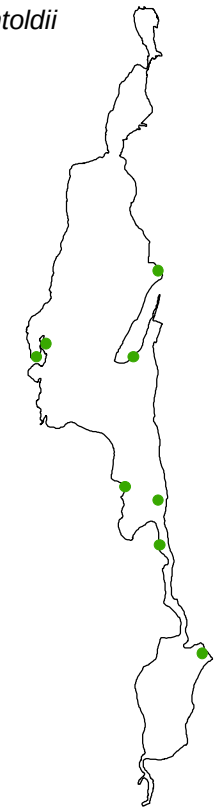
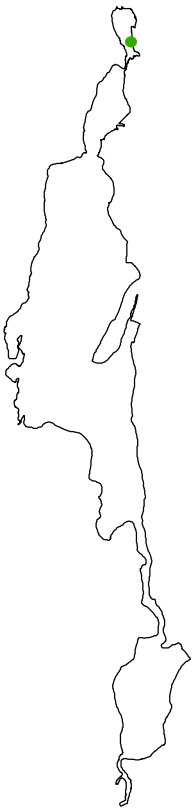
Potamogeton berchtoldii



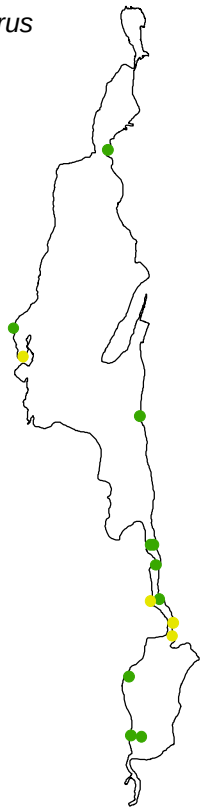
- Trace
- Sparse
- Moderate
- Dense

Potamogeton crispus



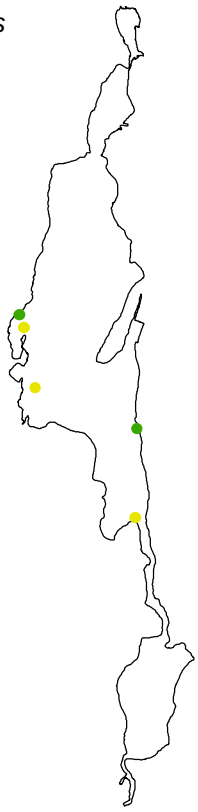
- Trace
- Sparse
- Moderate
- Dense

Potamogeton epihydrus



- Trace
- Sparse
- Moderate
- Dense

Potamogeton foliosus



- Trace
- Sparse
- Moderate
- Dense

Lake St. Catherine
Wells / Poultney, VT
Rutland County
43.4657° N, 73.2146° W

Lake St. Catherine

0 6,000 12,000 Feet

1:79,000

N

Map Date: 10/28/19
Prepared by: KS
Office: Shrewsbury, MA

Fall 2019 Native Vegetation Distribution (5 of 8)

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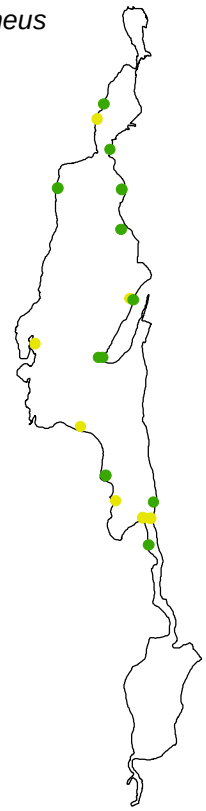
Potamogeton gramineus



- Trace
- Sparse
- Moderate
- Dense

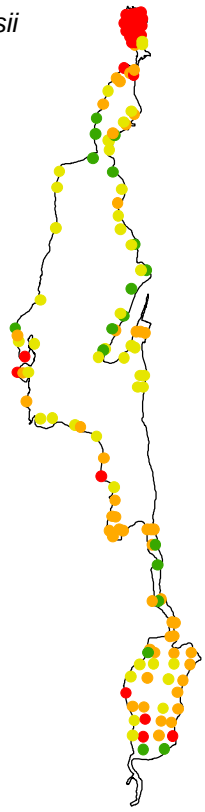
Potamogeton illinoensis

- Trace
- Sparse
- Moderate
- Dense

Potamogeton praelongus

- Trace
- Sparse
- Moderate
- Dense

Potamogeton robbinsii



- Trace
- Sparse
- Moderate
- Dense

Lake St. Catherine
Wells / Poultney, VT
Rutland County
43.4657° N, 73.2146° W

Lake St. Catherine

0 6,000 12,000 Feet

1:79,000

N

Map Date: 10/28/19
Prepared by: KS
Office: Shrewsbury, MA

Fall 2019 Native Vegetation Distribution (6 of 8)

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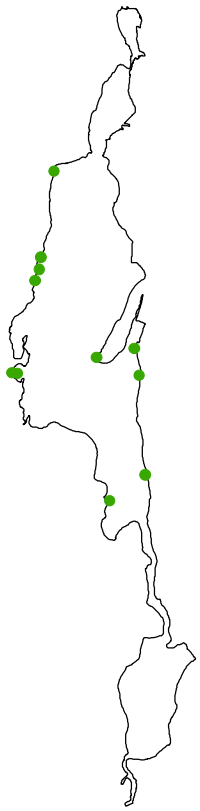
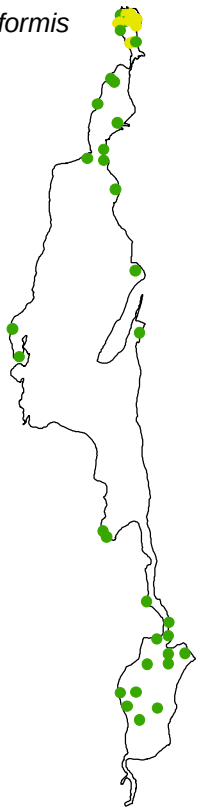
Potamogeton vaseyi



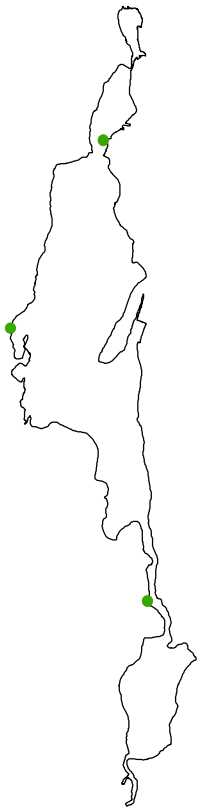
- Trace
- Sparse
- Moderate
- Dense

Potamogeton zosteriformis



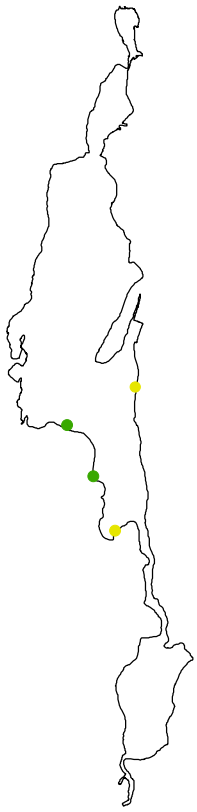
- Trace
- Sparse
- Moderate
- Dense

Ranunculus aquatilis



- Trace
- Sparse
- Moderate
- Dense

Stuckenia pectinata



- Trace
- Sparse
- Moderate
- Dense

Lake St. Catherine
Wells / Poultney, VT
Rutland County
43.4657° N, 73.2146° W

Lake St. Catherine

0 6,000 12,000 Feet

1:79,000

N

Map Date: 10/28/19
Prepared by: KS
Office: Shrewsbury, MA

Fall 2019 Native Vegetation Distribution (7 of 8)

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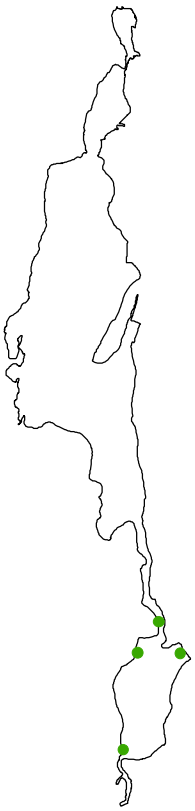
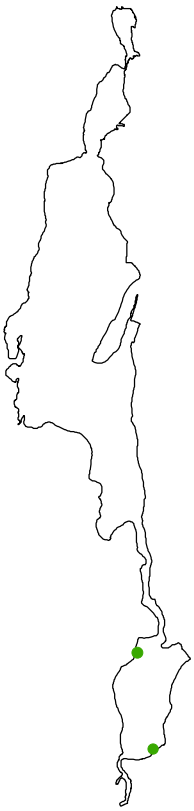
Utricularia gibba



- Trace
- Sparse
- Moderate
- Dense

Utricularia intermedia

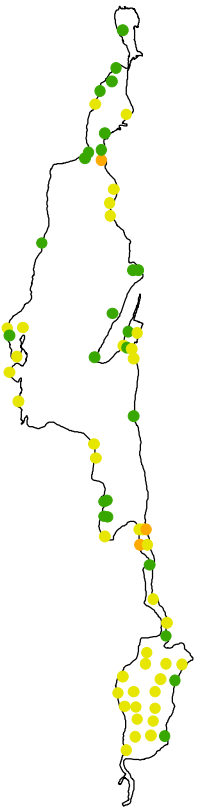


- Trace
- Sparse
- Moderate
- Dense

Utricularia vulgaris

- Trace
- Sparse
- Moderate
- Dense

Vallisneria americana



- Trace
- Sparse
- Moderate
- Dense

Lake St. Catherine
Wells / Poultney, VT
Rutland County
43.4657° N, 73.2146° W

Lake St. Catherine

0 6,000 12,000 Feet

1:79,000

N

Map Date: 10/28/19
Prepared by: KS
Office: Shrewsbury, MA

Fall 2019 Native Vegetation Distribution (8 of 8)

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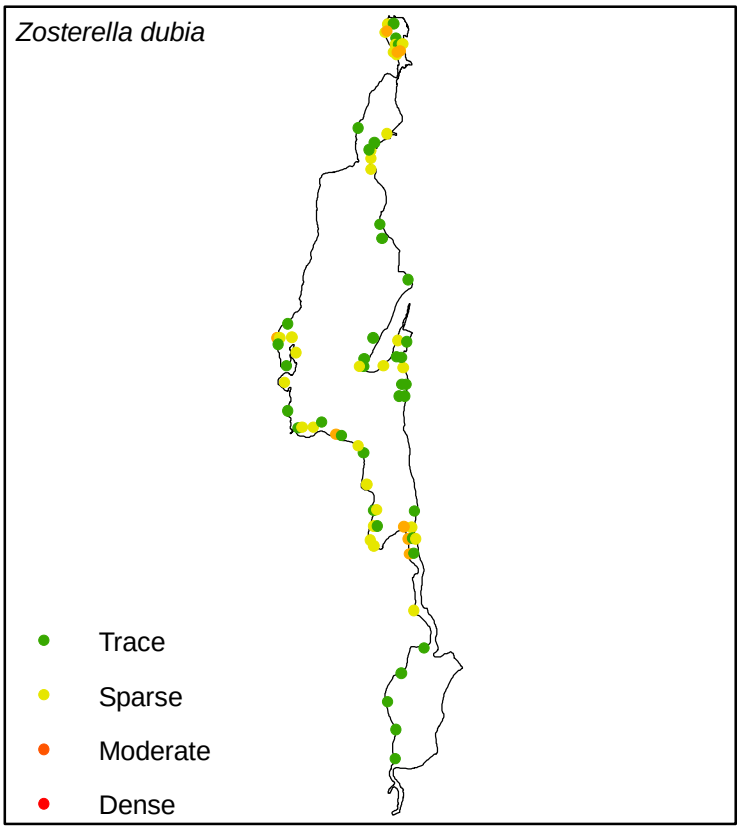

Lake St. Catherine
Wells / Poultney, VT
Rutland County
43.4657° N, 73.2146° W

Lake St. Catherine

0 6,000 12,000 Feet

N

1:79,000

Map Date: 10/28/19
Prepared by: KS
Office: Shrewsbury, MA

Fall 2019 Eurasian Watermilfoil Distribution

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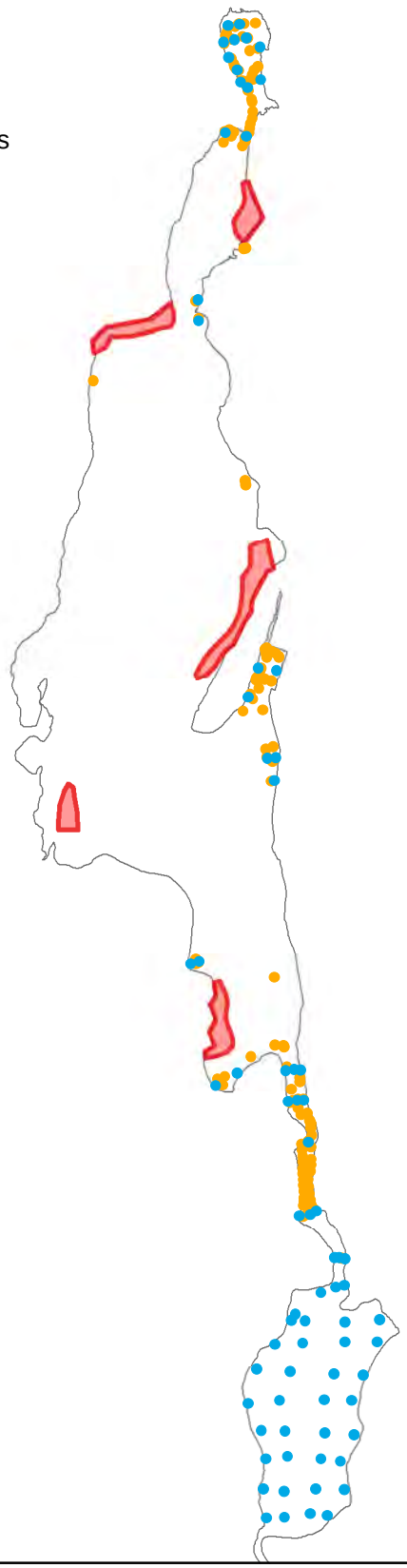
Legend

- Littoral zone EWM locations
- Pre-established point EWM locations
- 2019 Herbicide Treatment Areas



Lake St. Catherine
Wells / Poultney, VT
Rutland County
43.4657° N, 73.2146° W

Lake St. Catherine

0 3,000 6,000 Feet

1:37,000

N

Map Date: 10/28/19
Prepared by: KS
Office: SHREWSBURY, MA

IDENT	SPECIES RICHNESS	BMI	% COV ALL	% COV TRG	MS	BFA	BS	CD	CE	CH	D	EC	EN	IS	MV	NF	NGR	NGU	NI	NM	NO	NV	PA	PB	PC	PE	PF	PG	PI	PN	PPR	PPU	PR	PS	PV	PZ	SP	RA	UG	UI	UM	UPU	UV	VA	ZD
048	8	4	100	15	T			S				M									S		T										M										S		S
049	0	INACCESSIBLE																																											
050	9	4	100	15	T			S				S									M									T		D			T							T		S
051	8	4	100	5	T			T				S									M									D					S							T		T
052	6	4	100	0				T				M									S							T		D					S									
053	6	4	100	0				T				S									D								T	D											T		
054	8	4	100	30	S			T				M									T								T	D					S								S
055	7	2	100	10	T							S			T													T		D					T							T		
056	9	2	80	10	T			T	T			S											T						T	D					S							T		
057	8	4	100	0				T				M									M							T	S	D					S							T		
058	8	3	100	0				T				M									T		T						T	D					S									M
059	6	4	100	40	S			S													T		T							D					T									
060	6	4	100	0				T				S																	S	D											S	T	
061	6	3	100	0								S																T	S	D											S		T
062	9	4	100	20	T			S				M									D		S					S	S	D					S									
063	6	4	100	40	S				T			S									S		T							D													
064	5	3	100	0								S																	S	D											T		S
065	6	3	100	0								S											T					T	T	D											T		T
066	6	4	100	0				S				M									S		S							D													S
067	8	4	100	25	S			S				S									S		T							D											T		S
068	10	4	100	0		T		S				S									S		T					S		D					S							S		M
069	10	4	100	0		T		S				S									S		T					S		D					S							S		M
070	9	4	100	10	T			S				S									M				T			T		S					T							S		
071	5	4	100	0		D		T	S			S																		S													

24	7.04	3.7	99.13043	9.565217																																								

	T	7	2	0	9	2	0	0	0	0	0	1	0	0	0	0	0	3	0	8	0	1	0	0	0	6	0	6	0	0	0	0	4	0	0	0	0	0	0	9	1	3
	S	4	0	0	9	1	0	0	15	0	0	0	0	0	0	0	0	7	0	2	0	0	0	0	0	3	0	5	0	2	0	0	9	0	0	0	0	0	0	6	0	6
	M	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	3
	D	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0
	# COUNT	11	3	0	18	3	0	0	22	0	0	1	0	0	0	0	0	16	0	10	0	1	0	0	0	9	0	11	0	23	0	0	13	0	0	0	0	0	0	15	1	12
	%	45.8	12.5	0.0	75.0	12.5	0.0	0.0	91.7	0.0	0.0	4.2	0.0	0.0	0.0	0.0	0.0	66.7	0.0	41.7	0.0	4.2	0.0	0.0	0.0	37.5	0.0	45.8	0.0	95.8	0.0	0.0	54.2	0.0	0.0	0.0	0.0	0.0	0.0	62.5	4.2	50.0

IDENT	SPECIES RICHNESS	BMI	% COV ALL	% COV TRG	MS	BFA	BS	CD	CE	CH	D	EC	EN	IS	MV	NF	NGR	NGU	NI	NM	NO	NV	PA	PB	PC	PE	PF	PG	PI	PN	PPR	PPU	PR	PS	PV	PZ	RA	SP	UG	UI	UM	UPU	UV	VA	ZD
020	4	4	35	0								S																S				S		T										
021	3	2	20	0								T																T				T												
022	5	2	40	5	T							T																							T								M	S
023	6	4	100	0								M				T												M				T		T								T	
024	0	0	0	0																																								
025	3	1	25	0																			S						S													T	
026	9	4	35	5	T							S														T		T	S				S			T						T	S
027	1	3	15	0																								T															
028	5	4	75	0						T		T																M				S											S
029	5	4	40	0								T																T				S			T								T
030	3	4	45	0								T																T				T											
031	5	4	50	0								T																S	S			T											T
032	4	4	30	0						S											S							T				T											
033	5	4	75	0			T																					M				M										T	T
034	6	4	100	0								S									M	T						S				M											S
035	4	3	45	0								T											T									S		T									
036	7	4	100	0								T				S												S	S			M		T								S	
037	3	2	45	0								T																				S										T	
038	5	4	100	0								T											S					M				M										S	
039	1	1	30	0																												S											
040	0	0	0	0																																							
041	0	0	0	0																																							
042	5	4	75	0								S																S				M			T								T	
043	4	4	80	0								S																S				M			T									
044	5	4	100	15	T			T															T									D										T	
045	6	4	100	0				T				S											T					T				M										T	
046	5	4	100	0								S				T							S									D										T	
047	5	4	100	10	T				S																			T				M										M	
072	0	0	0	0																																							
073	2	2	50	0																												M										S	
074	5	3	60	0								T																S				S										S	T
075	0	0	0	0																																							
076	4	4	45	0		T						T																T				S											
077	6	4	55	0								T				T												S	S			S											T
078	2	1	15	0								T																				T											
079	2	3	45	0																								S				S											
080	4	4	50	0		T						T																S														T	
081	5	4	40	0		T						T				T												S						T									
082	3	4	30	0								T				T												S															
083	6	4	60	0												T								T				M				T										T	T
084	6	4	70	0								T				T												S				S		T								T	
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086	4	4	30	0		T						S																S						T									
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101	3	3	40	0																								T				T											T
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103	5	3	30	0								T				T												T							T								S
104	6	3	45	0								S				T											S	S				S										S	S
105	11	4	100	0								S				T							T	T		S		T		S		D			T							S	T
106	1	1	20	0																												S											
107	5	4	75	0												T												S				M										T	T
108	2	1	10	0								T				T																											
109	7	3	60	0								S				T								T				S	S			S											S
110	4	3	40	0								T					S											T				S											
111	4	3	35	0								S																T				T											T
112	6	3	40	0								T				T													T						T							T	T
113	5	3	40	0								T																	T			S											S
114	0	0	0	0																																							
115	7	4	90	0								S									T		S						T			D			T							S	
116	6	4	100	0								S				S													M			M			T								S
117	1	1	25	0																												S											
118	7	3	65	5	T							S				T							T									S			T								T
119	6	3	65	5	T							T				T												S				S											T
120	5	3	30	0								T				T													T													S	S
121	1	3	15	0																									T														

IDENT	SPECIES RICHNESS	BMI	% COV ALL	% COV TRG	MS	BFA	BS	CD	CE	CH	D	EC	EN	IS	MV	NF	NGR	NGU	NI	NM	NO	NV	PA	PB	PC	PE	PF	PG	PI	PN	PPR	PPU	PR	PS	PV	PZ	RA	SP	UG	UI	UM	UPU	UV	VA	ZD
122	3	1	35	0								S												T																					S
123	3	2	30	0								T																	T				S												
124	5	2	35	5	T							T																	T				S											S	
125	6	4	65	0								S								T									M				S											T	T
126	4	1	25	0								T																							T									S	T
127	5	4	100	20	T							T																					M											T	S
128	9	4	100	5	T		S													S	M								S				M			T							S	T
129	3	4	80	0								T																	S				M												
130	7	4	70	5	T							S				T													S				S					S						T
131	4	3	60	0								T																	S				S											T
132	0	0	0	0																																								
133	2	1	30	0								S															S																	
134	0	0	0	0																																								
135	4	4	45	0								S																	S				S												S
136	0	0	0	0																																								
137	7	4	85	0								S									S		S						M				M											S	T
138	0	0	0	0																																								
139	4	4	15	0																	T					T			T															T	
140	2	1	5	0												T																													T
141	4	3	40	0								T																	T				S												S
142	2	2	20	0																									T																T
143	5	4	65	0																			T						S				S					T						M
144	6	4	85	0						T		S																S	M				M												T
145	3	4	30	0								T															T		S																
146	0	0	0	0																																								
147	4	2	90	0								M											S																					S	T
148	4	3	100	0								S											S										M											S	
149	0	0	0	0																																								
150	0	0	0	0																																								
151	3	1	20	0						T		T																							T										
152	5	4	100	10	T							S																T	M															S
153	6	4	100	10	T							M											T						S				D												
154	0	0	0	0																																								
155	5	4	35	0								S				T								T					T				S												
156	4	1	20	0								T				T																												T	T
157	6	3	70	0								S																S					M		T									T	S
158	3	1	15	0								T																T																T
159	1	1	5	0																				T																				
160	3	2	45	0								T																S																S
161	6	4	60	0								S				T													S				M											T	S
162	6	4	80	0								T								T									T				M											T	T
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164	2	2	50	0								S																					M												
165	6	4	85	0								S											S						M				M			T								S
166	8	4	90	10	T																		T						M		T		M			T							S	S
168	6	4	55	0								S				T							T						S				S												S
169	4	2	45	0								T															S	S																M
170	6	3	80	10	T																		S								S		M											S	M
171	7	4	100	10	T							T											T								S		M											S	T
172	8	4	80	15	T							S											S						T		T		M											M	S
173	8	4	70	30	S											S			S					T				T														T	M	M
174	8	4	100	30	S							T											T			T			T		M		M												T
175	7	4	100	30	S							T											T			T					S		T											S	
17A	4	3	30	0								T																T	T				S												

132	3.98	2.7	47.34848	1.85606																																									

T	17	6	1	2	0	4	0	48	0	0	0	29	1	0	0	2	2	1	12	7	0	5	2	11	29	0	2	0	13	0	11	14	2	2	0	0	0	0	3	20	29
S	3	0	1	0	1	1	0	34	0	0	0	3	1	0	1	1	2	0	10	0	0	1	3	7	36	0	4	0	33	0	0	0	0	2	0	0	0	0	0	20	22
M	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	14	0	1	0	29	0	0	0	0	0	0	0	0	0	1	3	5
D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
#COUNT	20	6	2	2	1	5	0	85	0	0	0	32	2	0	1	3	7	1	22	7	0	6	5	18	79	0	7	0	75	0	11	14	2	4	0	0	0	0	4	43	56
%	15.2	4.5	1.5	1.5	0.8	3.8	0.0	64.4	0.0	0.0	0.0	24.2	1.5	0.0	0.8	2.3	5.3	0.8	16.7	5.3	0.0	4.5	3.8	13.6	59.8	0.0	5.3	0.0	56.8	0.0	8.3	10.6	1.5	3.0	0.0	0.0	0.0	0.0	3.0	32.6	42.4

IDENT	SPECIES RICHNESS	BMI	% COV ALL	% COV TRG	MS	BFA	BS	CD	CE	CH	D	EC	EN	IS	MV	NF	NGR	NGU	NI	NM	NO	NV	PA	PB	PC	PE	PF	PG	PI	PN	PPR	PPU	PR	PS	PV	PZ	SP	RA	UG	UI	UM	UPU	UV	VA	ZD
176	6	3	60	25	T							T														T					T		T										T	
177	10	4	100	45	S	T		T				S				T					S		M			T							M										S	
178	4	3	70	20	T	T						T																					T											
179	11	4	100	30	S	T	T	T				S									S		S			S							M			T								S	
180	11	4	100	20	T		S	T													D	T				S					T		M			T						S	S	
181	4	3	100	30	S	T																											M										S		
182	5	4	100	25	T		T														D		T																T					
183	12	4	100	15	T		T	T				T									M	S	S			S							M			T						S	T	
184	4	3	80	10	T			T																									M										T		
185	8	4	100	55	M							M									M		S						T							T						T		T
186	6	4	90	40	S	T	T														M								T				M												
187	10	4	100	30	S			T	T			T									M			T					T				M			T			T					
188	6	4	100	55	M							T											S						T				M			T								
189	8	4	100	75	D	T	T					T									S								T				M										S	
190	5	4	100	25	S																D												T						T	T				
191	6	4	100	80	D																T		T						T				S											T
192	6	4	100	55	M							T																	S				S			T						S	
193	7	4	100	75	D			T				T																	S				S			T						S	
194	5	4	90	60	M							T											T										M										S	
195	6	4	100	25	S			T				T											T										M										T	
196	5	4	100	65	M							T																	S				S										S	
197	4	4	100	50	M							T																					S											
198	8	4	100	35	S		S					T									S					T			T				S										S	
199	9	4	100	25	S	T						T									S								T				D			T						S	T
200	5	4	85	55	M							T																	S							T						S	
201	4	4	100	80	D							T																	T														S	
202	4	4	90	35	S							T																	S				M											
203	6	4	95	60	M							T																	S				M			T						S	
204	5	4	100	75	D							S																	S				M										S	
205	6	4	100	60	M							T																	S				S			T						S	
206	3	4	90	55	M							T																					M											
207	7	4	45	30	S	T		T				S									T												S											T
208	8	4	100	55	M							S				T							T						S				D			T						S	
209	6	4	100	60	M			T				S																	M				M										S	
210	5	4	80	35	S			T															S						T				M											
211	6	4	100	15	T							T									T		S										D										T	
212	6	4	100	55	M							T									T								S				M										S	
213	6	4	100	50	M							T														T			S				D										S	
214	5	4	60	30	S			S				T														T							S											
215	7	4	100	30	S	T						T									M																			T				S	T
216	5	3	20	5	T			T													T								S				T											
217	4	3	20	10	T		S																						S													T		
218	5	4	100	15	T		S														D												T							T				
43	6.26	3.9	90.11628	41.39535																																								

T	10	9	5	12	1	0	0	25	0	0	0	2	0	0	0	0	5	1	5	1	0	5	0	0	10	0	2	0	5	0	0	13	0	0	4	2	0	0	3	4	5
S	14	0	4	1	0	0	0	6	0	0	0	0	0	0	0	0	5	1	6	0	0	3	0	0	14	0	0	0	8	0	0	0	0	0	0	0	0	0	3	19	1
M	14	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	5	0	1	0	0	0	0	0	1	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0
D	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
# COUNT	43	9	9	13	1	0	0	32	0	0	0	2	0	0	0	0	19	2	12	1	0	8	0	0	25	0	2	0	37	0	0	13	0	0	4	2	0	0	6	23	6
%	100.0	20.9	20.9	30.2	2.3	0.0	0.0	74.4	0.0	0.0	0.0	4.7	0.0	0.0	0.0	0.0	44.2	4.7	27.9	2.3	0.0	18.6	0.0	0.0	58.1	0.0	4.7	0.0	86.0	0.0	0.0	30.2	0.0	0.0	9.3	4.7	0.0	0.0	14.0	53.5	14.0